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ABSTRACT

This guide is intended to assist vocational agriculture teachers who are teaching secondary- or postsecondary-level courses in agricultural power and machinery. The materials presented are based on the Arizona validated occupational competencies and tasks for the following occupations: service manager, shop foreman, service technician, and tractor mechanic. The guide includes competency/skill task lists, an employability skills charts crosswalk, an instructor's guide to 35 validated competencies, and an annotated bibliography. Each section of the curriculum guide contains the following: competency/skill, task, performance objective (including conditions, evaluation measure, and standard), suggested student learning experiences, suggested instructional techniques, necessary instructional equipment and materials, and recommended resources. Examples of the competencies covered include the following: applies approved safety practices in servicing/repairing agricultural power and machinery; prepares new and used power and machinery for sale; inspects bearings, gears, and surfaces for excessive wear and clearance; installs gaskets, O-rings, and seals to control fluid leakage; reads and interprets parts manuals/microfiche to access/order needed parts; operates microcomputers/terminals to access computerized parts inventories; calibrates and services/repairs components and systems of tractors and traction units needed in agricultural operations; practices good interpersonal relations skills; and prepares accurate reports and documents. (MN)

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AGRICULTURE POWER AND MACHINERY

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AGRICULTURE POWER AND MACHINERY

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ARIZONA CENTER FOR VOCATIONAL EDUCATION

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NORTHERN ARIZONA UNIVERSITY

SEPTEMBER, 1986

FOREWORD

The Agriculture Power and Machinery Competency Based Curriculum Guide has been developed for Vocational Agriculture Teachers who are delivering Programs of Agriculture Power and Machinery at the secondary or postsecondary level.

The guide is based on the Arizona validated occupational competencies and tasks for four occupations within the Agriculture Power and Machinery program cluster. The four occupations included in the cluster are Service Manager, Shop Foreman, Service Technician, and Tractor Mechanic.

Validated competencies have been utilized in curriculum design by both the Arizona Department of Education and the Community Colleges in Arizona. A major effort was made by both to insure that vocational education programs at both the secondary and postsecondary levels in similar areas utilized a single competency list. This curriculum now incorporates the newly-developed articulated list of validated competencies for Agriculture Power and Machinery.

This was accomplished by a group of educators including: Members of the State Board of Education and Committee to the Board on Vocational Education, State Community College Board Staff, Community College administrators and instructors, Arizona Department of Education staff, Northern Arizona University Curriculum Project Director, and high school teachers from around the state.

Each page of this guide includes information related to a specified task within the competency. For this reason the teacher can duplicate the pages directly from the curriculum guide which shows students the COMPETENCY/SKILL, TASK, PERFORMANCE OBJECTIVE, and STUDENT LEARNING EXPERIENCES. You are encouraged to supplement this guide with materials you have developed and other curriculum guides.

A sincere effort has been made to maintain the integrity of the industry-validated competencies, while preparing these materials for you. For that reason the instructor can be assured that the use of this guide as a basis for instruction in Agriculture Power and Machinery is consistent with the skills students need for employment in this field of Agriculture.

ACKNOWLEDGEMENTS

The Agriculture Power and Machinery Competency Based Curriculum Guide is the result of many people working together to insure quality curriculum for students seeking education and training in the agricultural occupations represented by the Agriculture Power and Machinery Program cluster.

The initial review of existing curriculum materials for their compatibility with the state curriculum model and the state validated competency list for Agriculture Power and Machinery was accomplished by Paul Wellman, a Vocational Agriculture teacher at Tolleson Union High School.

A committee of educators and business people was assigned the responsibility of determining if the existing curriculum materials reviewed by Paul Wellman could be adapted or adopted to meet our needs in Arizona. The committee determined that in large part an existing curriculum by Walker, Hattie M., et al., Agricultural Machinery Service: Instructional Resource Guide. Richmond: Agricultural Educational Service, Department of Education, 1983, could be adapted. The committee consisted of:

Don Snider
Arizona Machinery Company

Elmer Minch
Arizona Machinery Company

Marven Busby
St. David High School

Paul Wellman
Tolleson Union High School

The writing of the curriculum guide was done by Tom Rogers an instructor at Mesa Community College. Robert Wells of the Arizona Machinery Company and Nelson Nagle of Bingham Equipment Company were most helpful in providing Tom Rogers with materials to assist him in the writing of the curriculum guide. We would also like to recognize Leona Welch for her assistance in the typing of the final draft copy of the guide.

This curriculum guide incorporates the newly-developed articulated list of validated competencies for Agriculture Power and Machinery. The committee responsible for the articulated list included:

Tom Rogers
Mesa Community College

Don Lindsey
Buckeye Union High School

Paul Wellman
Tolleson Union High School

Pat Harrington
Central Arizona College

Clair Decker
Central Arizona College

Frank Downs
Duncan High School

Richard Newman
Arizona Western College

Dr. James L. Young
Cochise College

Dr. Philip Stiles
Arizona State University

Direction and leadership was provided by Richard Condit, State Supervisor of Agricultural Occupations, Doug Daley, Assistant State Supervisor of Agricultural Occupations, and Dave Muehlbauer, Curriculum Coordinator for the Arizona Department of Education, has resulted in a guide which reflects the most current practices and procedures in this area.

We are grateful to the entire staff of the Arizona Center for Vocational Education for their support, concern and assistance. Special thanks to the Curriculum Unit: Dr. Jerry R. Cox, Nancy F. Dillon, Kathi Jeffers, Cass Sandbakken, and the two computer input operators, Barbara Oftedahl and Sue Peters. In addition, we are grateful to Kathy Dunn for her leadership and assistance in getting the final curriculum guide completed, and Carole Ferlazzo for reviewing the curriculum for equity.

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AGRICULTURAL POWER EQUIPMENT AND MACHINERY JOB SPECIFIC COMPETENCIES

COMPETENCY	SERVICE MANAGER	SHOP FOREMAN	SERVICE TECHNICIAN	TRACTOR MECHANIC
1. Apply approved safety practices in servicing/ agricultural power and machinery.	Required	Required	Required	Required
2. Prepare new and used agricultural power machinery for sale.	Required	Required	Required	Optional
3. Inspect bearings, gears, and surfaces for excess wear and clearance.	Desirable	Required	Required	Required
4. Install gaskets, O-rings and seals on systems to control leakage of fluids and prevent leakage.	Desirable	Required	Required	Required
5. Read and interpret parts manual/microfiche to access/order needed parts for servicing/repairing.	Required	Required	Required	Desirable
6. Operate microcomputers/ terminals to access computerized inventory of parts.	Required	Required	Desirable	Optional

COMPETENCY	SERVICE MANAGER	SHOP FOREMAN	SERVICE TECHNICIAN	TRACTOR MECHANIC
7. Calibrate agricultural power and machinery for optimal use in agricultural operations.	Desirable	Required	Required	Required
8. Service/repair the fuel system of tractors and traction units needed.	Desirable	Required	Required	Required
9. Service/repair lubricating system of tractors and traction units needed for agricultural operations.	Desirable	Required	Required	Required
10. Service/repair the cooling system of tractors and traction units needed for agricultural operations.	Required	Required	Required	Required
11. Service/repair brake system of tractors and traction units needed for agricultural operations.	Desirable	Required	Required	Required
12. Overhaul the engine of tractors and traction units needed for agricultural operations.	Desirable	Required	Required	Required

COMPETENCY	SERVICE MANAGER	SHOP FOREMAN	SERVICE TECHNICIAN	TRACTOR MECHANIC
13. Service/repair the air and exhaust system of tractors and traction units needed for agricultural operations.	Desirable	Required	Required	Required
14. Service/repair the air conditioning system of tractors and traction units needed for agricultural operations.	Desirable	Required	Required	Required
15. Service/repair wheels of traction units needed for agricultural operations.	Desirable	Required	Required	Required
16. Service/repair the electrical system of tractors and traction units needed for agricultural operations.	Desirable	Required	Required	Required
17. Service/repair the clutch of tractors and traction units needed for agricultural operations.	Desirable	Required	Required	Required
18. Service/repair transmission of tractors and traction units needed for agricultural operations.	Desirable	Required	Required	Required

COMPETENCY	SERVICE MANAGER	SHOP FOREMAN	SERVICE TECHNICIAN	TRACTOR MECHANIC
19. Service/repair the differential on tractors and traction units needed for agricultural operations.	Desirable	Required	Required	Required
20. Service/repair the final drive on tractors and traction units needed for agricultural operations.	Desirable	Required	Required	Required
21. Service/repair the PTO on tractors and traction units needed for agricultural operations.	Desirable	Required	Required	Required
22. Service/repair the hydraulic system on tractors and traction units needed for agricultural operations.	Desirable	Required	Required	Required
23. Service/repair planters needed for agricultural operations.	Desirable	Required	Required	Required
24. Service/repair primary tillage equipment needed for agricultural operations.	Desirable	Required	Required	Required
25. Service/repair secondary tillage equipment needed for agricultural operations.	Desirable	Required	Required	Required

COMPETENCY	SERVICE MANAGER	SHOP FOREMAN	SERVICE TECHNICIAN	TRACTOR MECHANIC
26. Service/repair picking unit of cotton picker needed for agricultural operations.	Desirable	Required	Required	Required
27. Service/repair water system of cotton picker needed for agricultural operations.	Desirable	Required	Required	Required
28. Service/repair air system of cotton picker needed for agricultural operations.	Desirable	Required	Required	Required
29. Service/repair unit drive of cotton picker needed for agricultural operations.	Desirable	Required	Required	Required
30. Service/repair cabinet of cotton picker needed for agricultural operations.	Desirable	Required	Required	Required
31. Service/repair combines needed for agricultural operations.	Desirable	Required	Required	Required

COMPETENCY	SERVICE MANAGER	SHOP FOREMAN	SERVICE TECHNICIAN	TRACTOR MECHANIC
32. Practices personal and human relations skills.	Required	Required	Required	Optional
33. Safely adjusts and operates gas and electric arc welding equipment.	Desirable	Required	Required	Required
34. Uses and maintains hand/power and diagnostic tools.	Desirable	Required	Required	Required
35. Accurately prepares reports and documents.	Required	Required	Required	Optional

COMPETENCY/SKILL AND TASK LIST

1.0 Applies approved safety practices in servicing/repairing agricultural power and machinery.

- 1.1 Uses industrial quality personal safety equipment.
- 1.2 Installs safety machinery supports.
- 1.3 Operates fire extinguishers.
- 1.4 Administers first-aid.
- 1.5 Handles fuels and lubricants safely.
- 1.6 Uses safety high pressure fluid power systems.

2.0 Prepares new and used agricultural power and machinery for sale.

- 2.1 Demonstrates machinery.
- 2.2 Conducts pre-operation inspection.
- 2.3 Conducts new owner orientation and training.
- 2.4 Determines mechanical worth of used machinery and equipment.
- 2.5 Operates vapor and high pressure cleaning systems.

3.0 Inspects bearings, gears, and surfaces for excess wear and clearance.

- 3.1 Tests end play with dial indicator.
- 3.2 Measures clearances with plastigage.
- 3.3 Evaluates surface appearances of gears, bearing, and sliding parts.
- 3.4 Checks bearing preload with torque sensing tools.
- 3.5 Checks gear mesh with Prussian blue.
- 3.6 Checks gear backlash.

4.0 Installs gaskets, O-rings and seals on systems to control leakage of fluids and prevent damage.

- 4.1 Removes gaskets, O-rings and seals.
- 4.2 Utilizes lubricants and sealing compounds.
- 4.3 Adjusts fitting torque.
- 4.4 Selects replacement parts.
- 4.5 Installs replacement parts.

5.0 Reads and interprets parts manuals/microfiche to access/order needed parts for servicing/repairing.

- 5.1 Locates model-serial numbers.
- 5.2 Locates reference/figure number of parts.
- 5.3 Identifies part numbers.
- 5.4 Cross references part number update.
- 5.5 Locates parts from stock.
- 5.6 Lists parts on service orders.

6.0 Operates Microcomputers/Terminals to access computerized inventory of parts.

- 6.1 Accesses parts manuals/microfiche for parts number.
- 6.2 Accesses inventory by computer code.
- 6.3 Orders part from inventory.

7.0 Calibrates agricultural power and machinery for optimal use in agricultural operations.

- 7.1 Aligns electronic seed monitor instrument.
- 7.2 Adjusts machines for seed drop.
- 7.3 Selects type of chemical spray nozzle.
- 7.4 Sets distribution rate.
- 7.5 Adjusts orifice size.
- 7.6 Selects plate and drum size.
- 7.7 Selects drive sprocket size.
- 7.8 Sets harvesting efficiency of a combine.
- 7.9 Sets power shaft rpm.
- 7.10 Adjusts hitch to specifications.
- 7.11 Inflates transport wheel tires to specifications.

8.0 Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

- 8.1 Operates fuel testing equipment.
- 8.2 Locates malfunctioning components.
- 8.3 Rebuilds carburetor.
- 8.4 Installs fuel line.
- 8.5 Installs fuel line boots.
- 8.6 Replaces bleedline screen.
- 8.7 Replaces check valve.
- 8.8 Adjusts throttle.
- 8.9 Repairs throttle.
- 8.10 Replaces (installs) throttle.
- 8.11 Replaces gasket and O-ring.
- 8.12 Sets timing of injection pump.
- 8.13 Adjusts injection pump.
- 8.14 Replaces injection pump.
- 8.15 Replaces primer of fuel transfer pump.
- 8.16 Services/repairs/replaces fuel transfer pump.
- 8.17 Replaces fuel filters.
- 8.18 Replaces injector line.
- 8.19 Replaces injector washer.
- 8.20 Tests and adjusts injector.
- 8.21 Services/repairs/replaces fuel tank.

9.0 Services/repairs lubricating system of tractors and traction units needed for agricultural operations.

- 9.1 Takes oil sample for analysis.
- 9.2 Changes oil.
- 9.3 Changes filter.
- 9.4 Adjusts oil pressure.
- 9.5 Cleans oil pump inlet screen.
- 9.6 Services/rebuilds and installs oil pump.
- 9.7 Replaces drive assembly of oil pump.
- 9.8 Cleans oil pan.
- 9.9 Services/replaces oil cooler.

10.0 Services/repairs the cooling system of tractors and traction units needed for agricultural operations.

- 10.1 Visually checks coolant level/solution.
- 10.2 Installs water pump.
- 10.3 Rebuilds water pump.
- 10.4 Cleans radiator.
- 10.5 Tests radiator cap.
- 10.6 Repairs radiator.
- 10.7 Replaces radiator.
- 10.8 Services/repairs fan bearings, belt and pulley.
- 10.9 Replaces thermostat.
- 10.10 Replaces hoses.

11.0 Services/repairs brake system of tractors and traction units needed for agricultural operations.

- 11.1 Adjusts brakes.
  - 11.1.1 Adjusts brakes. (Pre-charge brake accumulator.)
- 11.2 Replaces brake pads, discs and pistons.
- 11.3 Relines brakes.
- 11.4 Replaces brake linings.
- 11.5 Replaces springs.
- 11.6 Rebuilds complete brake system.

12.0 Overhauls the engine of tractors and traction units needed for agricultural operations.

- 12.1 Replaces piston.
- 12.2 Replaces cylinder sleeves (dry).
  - 12.2.2 Replaces cylinder sleeves (wet).
- 12.3 Replaces connecting rods.
- 12.4 Rebushes connecting rods.
- 12.5 Replaces bolts.
- 12.6 Checks head for cracks/warpage.
- 12.7 Replaces gaskets.
- 12.8 Replaces camshaft.
- 12.9 Replaces crankshaft.
- 12.10 Grinds valves.
- 12.11 Replaces valve seats.
- 12.12 Replaces rocker arms.
- 12.13 Installs pushrod.
- 12.14 Installs short block.
- 12.15 Replaces crankshaft seals.
- 12.16 Replaces freeze plugs.

13.0 Services/repairs the air and exhaust system of tractors and traction units needed for agricultural operations.

- 13.1 Cleans and replaces air filter (dry element).
  - 13.1.1 Cleans and replaces air filter (oil-bath).
- 13.2 Replaces muffler.
- 13.3 Replaces exhaust manifold gasket.
- 13.4 Services/repairs, or replaces turbocharger.
- 13.5 Replaces innercooler.
- 13.6 Installs flex hose.
- 13.7 Installs turbocharger manifold coupler.

14.0 Services/repairs the air conditioning system of tractors and traction units needed for agricultural operations.

- 14.1 Tests system for leaks.
- 14.2 Charges system with freon.
- 14.3 Replaces expansion valve.
- 14.4 Repairs/replaces dryer.
- 14.5 Replaces hose.
- 14.6 Cleans evaporator.
- 14.7 Replaces evaporator.
- 14.8 Cleans condenser.
- 14.9 Replaces condenser.
- 14.10 Replaceas compressor.
- 14.11 Installs compressor belt.
- 14.12 Rebuilds compressor clutch.
- 14.13 Replaces blower motor.

15.0 Services/repairs wheels of traction units needed for agricultural operations.

- 15.1 Adjusts spacing.
- 15.2 Replaces duals.
- 15.3 Fills with ballast.
- 15.4 Changes tires.
- 15.5 Aligns front wheels.
- 15.6 Installs wheel weights.
- 15.7 Replaces wheel spindle.
- 15.8 Replaces bearings.
- 15.9 Replaces wheels.

16.0 Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

- 16.1 Replaces alternator/generator.
- 16.2 Replaces alternator/generator.
- 16.3 Replaces alternator/generator.
- 16.4 Replaces battery.
- 16.5 Checks/replaces battery fluids.
- 16.6 Installs radio.
- 16.7 Replaces wiring harness.
- 16.8 Replaces flasher relay.
- 16.9 Replaces solenoid.
- 16.10 Repairs lights.
- 16.11 Replaces oil pressure gauge.
- 16.12 Replaces oil pressure gauge.
- 16.13 Replaces fuel gauge.
- 16.14 Replaces engine temperature gauge.
- 16.15 Replaces hour meter.
- 16.16 Replaces starter relay.
- 16.17 Replaces starter drive.
- 16.18 Replaces starter.
- 16.19 Installs air-conditioning thermostat switch.
- 16.20 Replaces wiring.
- 16.21 Replaces circuit breaker.
- 16.22 Replaces thermal fuse.
- 16.23 Replaces steering motor bearings.

17.0 Services/repairs the clutch of tractors and traction units needed for agricultural operations.

17.1 Adjusts clutch.
17.2 Replaces clutch disc.
17.3 Replaces clutch seals.
17.4 Replaces clutch bushings.
17.5 Replaces clutch disk plate.
17.6 Replaces clutch springs bearings.
17.7 Replaces clutch damper.
17.8 Rebuilds clutch.

18.0 Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.1 Replaces hydrostatic motor seals.
18.2 Rebuilds hydrostatic motor.
18.3 Replaces hydrostatic motor.
18.4 Replaces air cooler.
18.5 Replaces pump input shaft.
18.6 Rebuilds pump.
18.7 Replaces pump.
18.8 Replaces U-joint.
18.9 Rebuilds U-joint.
18.10 Rebuilds top shaft.
18.11 Replaces top shaft gears.
18.12 Replaces bottom shaft gears.
18.13 Replaces shaft collars.
18.14 Replaces shaft bearings.
18.15 Adjust shifting linkage.
18.16 Rebuilds shaft quadrant.
18.17 Replaces shift cable.
18.18 Replaces shift retainer.
18.19 Replaces shifters.
18.20 Replaces shifting shaft.
18.21 Rebuilds two-speed pack.
18.22 Replaces front wheel drive U-joints.
18.23 Replaces front wheel drift shaft.
18.24 Replaces drive line U-joints.
18.25 Replaces reduction gear bearing retainer.
18.26 Cleans oil sump strainer.
18.27 Replaces hydrostat reservoir.
18.28 Replaces hydrostat fluid/filter.
18.29 Replaces gaskets.
18.30 Replaces hydrostatic drive belts.
18.31 Installs planetary drive shaft seal.
18.32 Replaces transmission case.

19.0 Services/repairs the differential on tractors and traction units needed for agricultural operations.

19.1 Sets bearings preload.
19.2 Replaces bearings.
19.3 Replaces ring gear.
19.4 Replaces pinon shaft.
19.5 Replaces housing.
19.6 Replaces lock.
19.7 Replaces disk.

19.8 Replaces piston.
19.9 Replaces lock plates.
19.10 Sets backlock.
19.11 Changes thrust washers.
19.12 Replaces quill.
19.13 Replaces differential.

20.0 Services/repairs the final drive on tractors and traction units needed for agricultural operations.

20.1 Replaces seals/bearings.
20.2 Rebuilds housing.
20.3 Replaces housing.
20.4 Replaces carrier.
20.5 Reconditions planetary pack.
20.6 Replaces gaskets.
20.7 Sets torque on axle nuts.
20.8 Replaces axle.
20.9 Replaces output-input shaft.
20.10 Replaces couplers.
20.11 Adds oil.
20.12 Replaces spacer.
20.13 Replaces bearing cup and cone.
20.14 Services/rebuilds final drive.

21.0 Services/repairs the PTO on tractors and traction units needed for agricultural operations.

21.1 Replaces shaft.
21.2 Replaces bearings.
21.3 Replaces disc.
21.4 Replaces drive plates.
21.5 Replaces oil lines.
21.6 Replaces seals.
21.7 Replaces gaskets.
21.8 Adjusts linkage.
21.9 Replaces quill assembly.
21.10 Rebuilds brake.
21.11 Replaces brake.
21.12 Rebuilds PTO.

22.0 Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.1 Rebuilds main pump.
22.2 Reseals main pump.
22.3 Replaces main pump.
22.4 Installs bushings.
22.5 Replaces belt.
22.6 Adjusts rockshaft housing control valves.
22.7 Replaces rockshaft.
22.8 Replaces rockshaft housing.
22.9 Rebuilds valve linkage.
22.10 Adjusts control linkage.
22.11 Reseals piston.
22.12 Replaces control cam and lock bolt.
22.13 Replaces bushings and seals.
22.14 Adjusts steering valve.

22.15 Replaces valve seats.
22.16 Rebuilds steering valve.
22.17 Replaces steering valve.
22.18 Reseals steering valve.
22.19 Rebuilds steering cylinder.
22.20 Replaces steering cylinder.
22.21 Reseals steering pump.
22.22 Repairs steering pump.
22.23 Replaces steering motor bearings.
22.24 Replaces steering motor mounts.
22.25 Rebuilds breakaway couplers.
22.26 Installs breakaway coupler.
22.27 Adjusts linkage of selective control valve.
22.28 Rebuilds coupler.
22.29 Rebuilds selective control valve.
22.30 Installs selective control valve.
22.31 Reseals main valve.
22.32 Replaces main valve.
22.33 Changes fluid filter.
22.34 Adjusts pressure.
22.35 Replaces hoses/pipe.
22.36 Rebuilds cylinder.
22.37 Reseals cylinder.
22.38 Replace cylinder.
22.39 Replaces feedback cylinder.
22.40 Charges accumulator.

23.0 Services/repairs planters needed for agricultural operations.

23.1 Sets up planter.
23.2 Adjusts row spacing.
23.3 Rebuild electronic monitors.
23.4 Replaces monitor sensor.
23.5 Rebuilds monitor harness.
23.6 Installs monitor.
23.7 Installs disc cappers.
23.8 Replaces gauge wheel.
23.9 Replaces coverers.
23.10 Installs hydraulic system tubes.
23.11 Installs seed box levers.
23.12 Installs drag chains.
23.13 Installs grain seeder.

24.0 Services/repairs primary tillage equipment needed for agricultural operations.

24.1 Sets up tillage equipment.
24.2 Prepares tillage equipment.
24.3 Checks hydraulic system.
24.4 Replaces moldboard components.
24.5 Replaces shanks.
24.6 Replaces shank points.

25.0 Services/repairs secondary tillage equipment needed for agricultural operations.

- 25.1 Sets up tillage equipment.
- 25.2 Checks electrical system.
- 25.3 Checks hydraulic system.
- 25.4 Installs stop kit.
- 25.5 Installs sweeps.

26.0 Services/repairs picking unit of cotton picker needed for agricultural operations.

- 26.1 Disassembles picker head.
- 26.2 Steam cleans/paints picker head.
- 26.3 Lubricates picker head.
- 26.4 Aligns bars.
- 26.5 Replaces grid bars.
- 26.6 Replaces spindles and bushings.
- 26.7 Reconditions picker bars.
- 26.8 Replaces bushings/studs of picker bars.
- 26.9 Adjusts level of picker bars.
- 26.10 Installs sleeves of picker bars.
- 26.11 Replaces cam arms of picker bars.
- 26.12 Reconditions picker drum heads.
- 26.13 Replaces grease tubes.
- 26.14 Replaces drum head.
- 26.15 Replaces top drive gear of drum shaft.
- 26.16 Replaces sun gears of drum shaft.
- 26.17 Replaces idler gears and bearings.
- 26.18 Reconditions doffer.
- 26.19 Aligns doffer.
- 26.20 Replaces drive chain.

27.0 Services/repairs water system of cotton picker needed for agricultural operations.

- 27.1 Reconditions moistener column.
- 27.2 Sets moistener columns.
- 27.3 Rebuilds water pump.
- 27.4 Replaces water pump.
- 27.5 Installs water pump restraint kit.
- 27.6 Reconditions pressure plates.
- 27.7 Replaces flaps on pressure plates.
- 27.8 Replaces pressure plates.

28.0 Services/repairs air system of cotton picker needed for agricultural operations.

- 28.1 Replaces air ducts.
- 28.2 Replaces blower fan belt.

29.0 Services/repairs unit drive of cotton picker needed for agricultural operations.

- 29.1 Replaces belts.
- 29.2 Replaces coutner shaft.
- 29.3 Replaces U-joints.

30.0 Services/repairs cabinet of cotton picker needed for agricultural operations.

- 30.1 Replaces wear clamps.
- 30.2 Hardsurfaces skid plates.
- 30.3 Reconditions stall lifters.
- 30.4 Replaces seals and bearings.
- 30.5 Adjusts head.

31.0 Services/repairs combines for agricultural operations.

- 31.1 Attaches head (grain or corn).
- 31.2 Replaces/adjusts cylinder (rotor).
- 31.3 Replaces rasp bars.
- 31.4 Replaces beater.
- 31.5 Replaces rear cross auger.
- 31.6 Replaces auger drive countershaft.
- 31.7 Replaces auger drive bearings.
- 31.8 Tightens cable on loading auger.
- 31.9 Sets up platform.

32.0 Practices personal and human relations skills. (For all of Competency/Skill 32.0, see Agriculture Business and Management Competency/Skill 7.0.)

- 32.1 Makes decisions when necessary.
- 32.2 Listens well.
- 32.3 Gets along with people.
- 32.4 Communicates effectively.
- 32.5 Follows and provides instructions.
- 32.6 Works irregular hours occasionally.
- 32.7 Develops self-confidence.
- 32.8 Cooperates with fellow workers.
- 32.9 Delegates responsibility when necessary.
- 32.10 Promotes (sells) yourself and your firm.
- 32.11 Identifies factors which make for job success and satisfaction.
- 32.12 Gives needed advice diplomatically.
- 32.13 Meets people easily.
- 32.14 Works under stress.
- 32.15 Evaluates performance continually.
- 32.16 Dresses appropriately for the job.
- 32.17 Remembers names and faces.
- 32.18 Judges management and production potential of people.

33.0 Safely adjusts and operates gas and electric arc welding equipment.

- 33.1 Sets up, tests and adjusts gas welding equipment.
    - 33.1.1 Sets up, tests and adjusts electric arc welding equipment.
- 33.2 Welds using oxy-acetylene equipment.
- 33.3 Flame-cuts using oxy-acetylene equipment.
- 33.4 Welds using AC and DC arc welding equipment.
- 33.5 Builds up worn or damaged base metal to original specifications.
- 33.6 Applies hard-facing to various metal surfaces.

34.0 Uses and maintains hand, power and diagnostic tools.

- 34.1 Knows and observes shop safety precautions.
- 34.2 Uses screwdrivers.
- 34.3 Uses hammer.
- 34.4 Uses pliers.
- 34.5 Uses wrenches.
- 34.6 Uses a torque wrench.
- 34.7 Uses micrometers.

35.0 Accurately prepares reports and documents.

- 35.1 Writes work orders.
- 35.2 Prepares estimations of cost for services.
- 35.3 Orders parts.

The Employability Skills Charts, which follow, are used to show a crosswalk between the charts and the curriculum guide. Numbers next to **RELATED BASIC SKILLS**, **JOB SKILLS** and **RESPONSIBILITY SKILLS** are the competency or task numbers in the curriculum. To determine which employability skill may be incorporated into teaching, compare the skill with the competency or task number shown.

Service Department Manager
Related Basic Skills

MATHEMATICS

5,6	Uses computer skills to maintain inventories and fiscal records.
	Applies the basic arithmetic processes of credit, for example: interest, installment, principal and collateral.
	Interprets charts, tables and graphs.
	Demonstrates an understanding of the concepts of, and calculates, the net and gross pay accounts on paychecks.

SCIENCE

7,8,12, 18-26, 28,29,31	Solves complex problems including acceleration, average velocity and displacement.
	Uses various systems and measuring techniques to gather graph and analyze data on electrical and hydraulic systems.

COMMUNICATIVE ARTS

1-31	Distinguishes fact from opinion in reviewing product information.
1-31	Collects, organizes and analyzes information for specific purposes.
	Writes business letters.
1-31	Gives oral and written directions.
1-31	Develops written reports utilizing graphs, charts and diagrams.

Service Department Manager

Job Skills

1-31	Maintains equipment inventory and reorders supplies.
1-31	Supervises workers.
1-31	Keeps personnel records.
1-31	Calculates costs and returns for labor, parts and equipment.
1-31	Contracts with suppliers.
1-31	Obtains and uses credit.
1-31	Employs cost-control procedures for labor and equipment.
1-31	Utilizes basic principles of inventory, warehousing, purchasing and quality control of repairs to equipment.
1-31	Prepares bids on outside service work.

Service Department Manager

Responsibility Skills

1-31	Demonstrates effective interpersonal and social skills.
1-31	Creates a positive work environment.
1-31	Provides opportunities for employee growth.
1-31	Manages the business effectively and efficiently.
1-31	Displays honest and professional behavior.
1-31	Promotes customer satisfaction.
1-31	Demonstrates leadership, supervisory and management abilities.
1-31	Analyzes and solves complex problems and conflicts.

Shop Foreman
Related Basic Skills

MATHEMATICS

2,3,7,8, 12,16-27, 31	Performs computations involving one or more than one of the basic operations of addition, subtraction, multiplication and division with whole numbers, decimals, fractions and integers.
3,4,7,8, 11-13, 16-31	Estimates measurements.
2-4,7,8, 11-13, 16-31	Gathers and organizes information and formulates a problem from same.

SCIENCE

3,4,7-9, 11-31	Identifies variables that affect the motion of objects.
9-12, 17-21, 24-26, 29-31	Understands the characteristics of metals.
7-14, 16-29,31	Solves problems involving force, work, power and energy.
1,2,7, 23-26, 28-31	Identifies levers by classes and parts.
2,7, 23-26,31	Solves simple motion problems including distance, rate and time.

COMMUNICATIVE ARTS

1-31	Uses evidence to express and support recommendations.
1-31	Asks questions to find essential information.

Shop Foreman
Job Skills

1-31	Organize jobs and supervise workers.
5,6	Maintains records and makes reports.
1-31	Instructs mechanics in the performance of jobs assigned to them.
1-31	Trains new employees in the effective and efficient use of all tools and/or equipment used in power and machinery mechanics.
1-31	Inspects equipment for proper use and maintenance.
1-31	Develops work schedules.
1-31	Maintains a clean and efficient service department.
5,6	Uses and maintains parts and service manuals.
1-31	Inspects and diagnoses malfunctions pertaining to power and machinery equipment.
1-31	Uses OSHA prescribed safety procedures within the shop.

Shop Foreman

Responsibility Skills

1-31 Demonstrates integrity relative to product information.

1-31 Assesses personal strength and weaknesses relative to product knowledge.

1-31 Uses initiative and imagination to solve problems within the scope of the job.

1-31 Demonstrates personal confidence and appropriate sense of humor.

1-31 Promotes good customer relations.

Maintains information on current practices in the landscape industry.

Service Technician

Related Basic Skills

MATHEMATICS

3-9, 11-13, 15-23, 26,30,31	Recognizes metric prefixes.
2,3,7,8 12,16-27, 31	Uses addition, subtraction, multiplication and division.
2,7,8,12, 13,17-28, 31	Solves problems involving ratio and proportion.
2,3,7,8, 12,13, 17-31	Solves problems dealing with measurements including weight, area, capacity and temperatures.

SCIENCE

1,2,7, 23-26, 28-31	Recognizes and uses simple machines such as levers, pulleys and inclined planes.
7-14, 16-29,31	Identifies and investigates the sources and characteristics of the various forms of energy, such as, mechanical, electrical, thermal and radiant.
2,8-10, 12,13	Applies diesel engine theory.

COMMUNICATIVE ARTS

1-31	Asks appropriate questions to find essential information.
1-31	Reports orally and in writing.
1-31	Interprets schedules and manuals.
1-31	Reads and follows written documents; listens to and follows oral directions.
1-31	Communicates effectively with customers.

Service Technician

Job Skills

1-31	Identifies shop tools and equipment.
1-31	Maintains and services power machinery.
1-31	Repairs hydraulics.
7,23-25	Maintains and adjusts planting equipment systems.
7,23-25	Maintains and adjusts tillage equipment systems.
31	Maintains and adjusts combine systems.
	Maintains and adjusts forage harvesting systems.
1-31	Performs general shop tasks.
1-31	Maintains shop safety.
1-31	Maintains appropriate business records and schedules.
	Performs all welding tasks. Example: arc, gas, wire feed.
16	Repairs electrical systems.

Service Technician
Responsibility Skills

1-31	Follows through, to completion, assigned tasks and record keeping.
1-31	Reports accidents and potential safety problems promptly to the appropriate supervisor.
1-31	Works well under pressure and manages stress.
1-31	Demonstrates an attitude of service and cooperation in dealing with employer and fellow employees.
1-31	Exhibits pride in work and a willingness to learn about new procedures and products.
1-31	Practices safe and efficient work habits.
1-31	Demonstrates initiative and problem solving skills.
1-31	Follows chain of command and recognizes limits of responsibilities.
1-31	Follows the policies and procedures of the place of employment.
1-31	Works to produce a quality product.

1.0 COMPETENCY/SKILL: Applies approved safety practices in servicing/repairing agricultural power and machinery.

1.1 TASK: Uses industrial quality personal safety equipment.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given personal protective equipment, instruction in safe operation of power tools and necessary equipment and supplies,

EVALUATION: successfully demonstrate good safety practices.

STANDARD: These practices must be those identified by the instructor as being necessary.

STUDENT LEARNING EXPERIENCES:

1. Follow general safety instructions in the use of personal safety equipment, laboratory equipment, and supplies.

2. Demonstrate the proper use of tools, equipment, supplies, and personal safety equipment.

3. Demonstrate how to properly operate the fire extinguisher located in the Agricultural Machinery Service Laboratory.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Identify and demonstrate the use of the types of fire extinguishers found in the Agricultural Machinery Service Laboratory.

2. Provide safety instruction in the use of personal safety equipment, laboratory equipment, and supplies.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Shop safety manuals.
2. Mechanics tool set.
3. Personal safety equipment.
4. Laboratory equipment and supplies.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

1.0 **COMPETENCY/SKILL:** Applies approved safety practices in servicing/repairing agricultural power and machinery.

1.2 **TASK:** Installs safety machinery supports

PERFORMANCE OBJECTIVE:

CONDITIONS: Given personal protective equipment, instruction in shop safety procedures, necessary equipment and supplies,

EVALUATION: successfully demonstrate installing safety machinery supports on designated tractor.

STANDARD: Demonstrate good safety practices in the proper use of safety machinery supports. Safety practices demonstrated must be those identified by the instructor as being necessary.

STUDENT LEARNING EXPERIENCES:

1. Discuss general safety procedures in the use of personal safety equipment, shop safety equipment, and supplies.

2. Demonstrate the proper use of safety machinery supports.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Identify and demonstrate the use of the types of safety machinery supports found in the Agricultural Machinery Service Laboratory.

2. Provide safety instruction in the use of personal safety equipment, laboratory equipment, and supplies.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Mechanics tool set.
2. Shop safety manuals.
3. Personal safety equipment.
4. Shop safety equipment.
5. Supplies.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

1.0 **COMPETENCY/SKILL:** Applies approved safety practices in servicing/repairing agricultural power and machinery.

1.3 **TASK:** Operates fire extinguishers.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given instruction in shop safety procedures, and necessary equipment and supplies,

EVALUATION: Successfully operate fire extinguisher.

STANDARD: Proper operation must be that identified by the instructor as being necessary.

STUDENT LEARNING EXPERIENCES:

1. Discuss general safety instructions in the use of personal safety equipment, shop safety equipment, and supplies.

2. Discuss the use of various types of fire extinguishers.

3. Demonstrate the proper use of fire extinguishers.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Identify and demonstrate the use of the types of fire extinguishers found in the Agricultural Machinery Service Laboratory.

2. Provide safety instruction in the use of personal safety equipment, laboratory equipment, and supplies.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Shop safety manuals.
2. Various types of fire extinguishers.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

1.0 **COMPETENCY/SKILL:** Applies approved safety practices in servicing/repairing agricultural power and machinery.

1.4 **TASK:** Administers first-aid.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given instruction in first-aid applications, necessary equipment and supplies,

EVALUATION: demonstrate administering first-aid.

STANDARD: These practices must be those identified by the instructor as being necessary.

STUDENT LEARNING EXPERIENCES:

1. Discuss general safety instructions in the use of personal safety equipment, shop safety equipment, and supplies.

2. Discuss the various methods of first-aid application to types of injuries associated with agricultural machinery service.

3. Demonstrate administering first-aid for specified types of injuries.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Identify and demonstrate the various methods of first-aid application to types of injuries associated with agricultural machinery service.

2. Provide safety instruction in the use of personal safety equipment, laboratory equipment, and supplies.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. First-aid manuals.
2. First-aid kits.
3. Personal safety equipment.
4. Laboratory equipment.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

1.0 **COMPETENCY/SKILL:** Applyies approved safety practices in servicing/repairing agricultural power and machinery.

1.5 **TASK:** Handles fuels and lubricants safely.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given personal protective equipment, instruction in safe handling of fuels and lubricants, necessary equipment and supplies,

EVALUATION: successfully demonstrate good safety practices in the proper handling and storage of fuels and lubricants.

STANDARD: These safety practices must be those identified by the instructor as being necessary.

STUDENT LEARNING EXPERIENCES:

1. Discuss general safety instructions in the use of personal safety equipment, shop safety equipment, and supplies.
2. Discuss the proper handling procedures for fuels and lubricants.
3. Discuss recommended safety procedures used when refueling agricultural power equipment.
4. Discuss emergency safety procedures to use for fuel spills.
5. Discuss fuels and lubricants storage safety.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Provide safety instruction in the handling and storage of fuels and lubricants.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Personal protective equipment.
2. Storage facilities.
3. Supplies.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

1.0 **COMPETENCY/SKILL:** Applies approved safety practices in servicing/repairing agricultural power and machinery.

1.6 **TASK: Uses safety high pressure fluid power systems.**

PERFORMANCE OBJECTIVE:

CONDITIONS: Given personal protective equipment, instruction in safe use of high pressure fluid power systems, necessary equipment and supplies,

EVALUATION: demonstrate good safety practices.

STANDARD: Safety practices demonstrated must be those identified by the instructor as being necessary.

STUDENT LEARNING EXPERIENCES:

1. Discuss general safety instructions in the use of personal safety equipment, laboratory equipment, and supplies.

2. Demonstrate the proper use of tools, equipment, supplies, and personal equipment when servicing/repairing designated equipment.

3. Discuss the hazards of servicing, repairing, or operating equipment machinery or equipment equipped with hydraulic systems.

4. Discuss hazards associated with steam cleaning units.

5. Demonstrate good safety practice in the use of high pressure fluid power systems.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Provide safety instruction in the use of personal safety equipment, laboratory equipment, and supplies.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Personal safety equipment.
2. A high pressure fluid power system (steam cleaner).
3. Laboratory equipment.
4. Supplies.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

2.0 **COMPETENCY/SKILL:** Prepares new and used agricultural power and machinery for sale.

2.1 **TASK:** Demonstrates machinery.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a tractor, safely and efficiently operate the tractor and any attached equipment,

EVALUATION: demonstrate the correct start-up and shut-down procedures for the tractor. Connect and disconnect implements to a tractor hitch, power take-off (PTO), and hydraulic system.

STANDARD: Safely and efficiently operate a tractor and any attached equipment.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of tractor operation.
2. List guidelines for efficient tractor operations.
3. Describe the instrument panel, including location of controls and the meaning of symbols.
4. Discuss the correct start-up and shut-down procedures for the tractor.
5. Identify the laws pertaining to traffic operation.
6. Connect and disconnect implements to a tractor hitch, power take-off (PTO), and hydraulic system.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Complete a tractor safety check.

2. Demonstrate uses of an operations manual.

3. Demonstrate the ability to correctly operate a tractor.

4. Demonstrate how to correctly hitch and unhitch an implement from a tractor.

5. Discuss the safety aspects of operating a tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. An agricultural (farm) tractor.
2. Associated implements.
3. Necessary equipment.
4. Supplies.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: AGRICULTURAL MACHINERY SAFETY. John Deere Company, Moline, IL. 1974.

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

2.0 **COMPETENCY/SKILL:** Prepares new and used agricultural power and machinery for sale.

2.2 **TASK:** Conducts pre-operation inspection.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a tractor, operator's manual and checklist,

EVALUATION: conduct pre-operation inspection.

STANDARD: Following operator's checklist, safely and efficiently conduct a pre-operation inspection.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of tractor operation.
2. Discuss the importance of preventive maintenance.
3. Demonstrate pre-operation inspection.
4. Identify and list signs of deterioration of functional units on the tractor which may need immediate attention.
5. Check for deterioration of seals, oil leaks, fuel leaks, and worn parts.
6. Check all fluid levels.
7. Check sediment bowls.
8. Complete inspection by checking hitch area, pedal movement for excessive play, and instrument panel prior to engine start-up.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

See Task 2.1.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A tractor.
2. An operator's manual.
3. Tractor checklist.

RESOURCES:

Jacobs, Clinton O., Mervin, Stearns, Keith E. Mattox. FARM TRACTOR MAINTENANCE: A UNIT OF INSTRUCTION ON FARM TRACTOR MAINTENANCE FOR VOCATIONAL AGRICULTURE. Department of Agricultural Education, University of Arizona, Tucson, AZ. 1975.

2.0 **COMPETENCY/SKILL:** Prepares new and used agricultural power machinery for sale.

2.3 **TASK:** Conducts new owner orientation and training.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a tractor, safely and efficiently operate the tractor and any attached equipment.

EVALUATION: explain to the new owner the performance capabilities of the equipment.

STANDARD: Safely and efficiently demonstrate a tractor and any attached equipment to the new owner.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of tractor operation.
2. List guidelines for efficient tractor operation.
3. Describe the instrument panel, including location of controls and the meaning of symbols.
4. Discuss the correct start-up and shut-down procedures for the tractor.
5. Identify the laws pertaining to tractor operation.
6. Connect and disconnect implements to a tractor hitch, power take-off (PTO), and hydraulic system.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Complete a tractor safety check.
2. Demonstrate uses of an operational manual.
3. Demonstrate the ability to correctly operate a tractor.
4. Demonstrate how to correctly hitch and unhitch an implement.
5. Discuss the safety aspects of operating a tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A tractor.
2. An operator's manual.
3. Tractor checklist.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

2.0 **COMPETENCY/SKILL:** Prepares new and used agricultural power and machinery for sale.

2.4 **TASK:** Determines mechanical worth of used machinery and equipment.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given used agricultural equipment,

EVALUATION: determine the mechanical worth of machine or equipment.

STANDARD: Determined mechanical worth of machine or equipment must be in agreement with value stated by instructor.

STUDENT LEARNING EXPERIENCES:

1. Discuss the methods used to determine the worth of used machinery and equipment.
2. Discuss the value of the general appearance and year manufactured.
3. Discuss the importance of mechanic's report after preliminary inspection of engine, power train, cooling system, hydraulic system, electrical system, and tires.
4. Discuss the engine time and maintenance records for designated equipment.
5. Calculate the value based on "Agricultural Machinery Data" in AGRICULTURAL ENGINEERS YEARBOOK.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the importance of maintenance records of used agricultural power equipment and machinery.
2. Calculate the mechanical worth of designated equipment.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Used agricultural machinery and equipment.

RESOURCES:

Herbst, J. H. FARM MANAGEMENT: PRINCIPLES, BUDGET, PLANS. Stipes Publishing Company, Champaign, IL. 6TH REV. ED. 1983.

2.0 **COMPETENCY/SKILL:** Prepares new and used agricultural power and machinery for sale.

2.5 **TASK:** Operates vapor and high pressure cleaning systems.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a steam cleaner, power source, and water supply,

EVALUATION: prepare the steam cleaner for use.

STANDARD: The preparation must include accepted completion of all steps listed on the instructor's checklist and recommended by the manufacturer.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of operating a steam cleaner.
2. Discuss steps involved in the operation of steam cleaner.
3. Safely operate a steam cleaner.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Review the safety aspects of operating a steam cleaner.
2. Demonstrate the steps involved in the operation of a steam cleaner.
3. Demonstrate the ability to complete all of the steps in preparing a steam cleaner for use.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A steam cleaner, power source, water supply, operator's manual and checklist.

RESOURCES:

A CATALOG OF PERFORMANCE OBJECTIVES, CRITERION-REFERENCED MEASURES AND PERFORMANCE GUIDES FOR TRACTOR MECHANIC. Vocational-Technical Education Consortium of States (V-TECS), Atlanta, GA. 1976.

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

3.0 **COMPETENCY/SKILL:** Inspects bearings, gears, and surfaces for excess wear and clearance.

3.1 **TASK:** Tests end play with dial indicator.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a gear shaft with too much end-play, the service manual, dial indicator, shims, and necessary tools,

EVALUATION: measure the end-play movements in the gear shaft.

STANDARD: Measure and adjust end-play movement in a gear shaft so that the dial indicator readings agree with those of the instructor's and adjustments are to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Display proper safety precautions.
2. Discuss service manual instructions pertaining to reaching gears and shaft.
3. Demonstrate how to mount dial indicator against side of a gear or end of a shaft, how to pry shaft or gear in both directions, and how to note difference between two readings on dial indicator.
4. Demonstrate how to adjust the end play with shims or adjusting nuts to manufacturer's specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study the power train section in the appropriate shop manual (I&T) or manufacturer's service manual for the designated tractor in order to determine end-play specifications.

2. Respond to the following:

   a. What is end-play?
   b. What causes end-play?
   c. Why must it be necessary to preload the bearing?

3. Measure the end-play movement in the gear shaft of the power train on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A gear shaft with too much end-play, the service manuals, dial indicator, shims, and necessary tools and equipment.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: PREVENTIVE MAINTENANCE. John Deere Company, Moline, IL. Page 195. 1984.

FUNDAMENTALS OF SERVICE: POWER TRAINS. John Deere Company, Moline, IL. Pages 2-20. 1969.

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

3.0 **COMPETENCY/SKILL:** Inspects bearing, gears, and surfaces for excess wear and clearance.

3.2 **TASK:** Measures clearances with plastigage.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given plastigage for measuring equipment clearances,

EVALUATION: demonstrate the use of plastigage and knowledge of the need for the information gained by plastigage use.

STANDARD: Measurements should concur with those of the instructor (+2%).

STUDENT LEARNING EXPERIENCES:

1. Discuss the use of plastigage.
2. Use plastigage to measure bearing to journal clearance on a crankshaft.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Review the instruction manual for plastigage use.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Plastigage, necessary tools and equipment

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

3.0 **COMPETENCY/SKILL:** Inspects bearings, gears, and surface for excess wear and clearance.

3.3 **TASK:** Evaluates surface appearances of gears, bearing, and sliding parts.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the manufacturer's service manual, oil, needed replacement parts, tools, and equipment,

EVALUATION: service a sliding-gear transmission on designated tractor, following manufacturer's instructions.

STANDARD: All parts must be clean and must operate to manufactuer's specifications. Replacement parts should be installed where necessary.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate proper safety procedures.
2. Demonstrate how to remove transmission according to directions in service manual for specific tractor and type of transmission.
3. Discuss how to clean all parts and make oil change.
4. Explain how to prevent subsequent damage to tractor.
5. Demonstrate how to reassemble all parts and replace transmission according to manufacturer's instructions and specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study the section on disassembly and reassembly of transmission in the appropriate shop manual or manufacturer's service manual.

2 Respond to the following:

   a. Define the sliding-gear
   b. What are the two basic designs?
   c. What are the differences between the two basic designs?
   d. What are five things to look for when doing general maintenace on a sliding-gear transmission?

3. Service the sliding-gear transmission on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Manufacturer's service manual, a sliding-gear transmission, oil, needed replacement part, tools, and equipment.

RESOURCES:

FUNDAMENTALS OF SERVICE; POWER TRAINS. John Deere Company, Moline, IL. Pages 3-13. 1969.

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

3.0 **COMPETENCY/SKILL:** Inspects bearings, gears, and surfaces for excess wear and clearance.

3.4 **TASK:** Checks bearing preload with torque sensing tools.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a gear train which needs preloading, the manufacturer's service manual, shims, a dial indicator, and necessary tools,

EVALUATION: preload the bearings in the gear train.

STANDARD: Preload bearings in the gear train according to service manual. Shims should be correctly installed and adjusted. Final dial indicator readings must agree with those of the instructor and should be to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Display proper safety precautions.
2. Discuss service manual instructions pertaining to reaching gear and pinion.
3. Demonstrate how to check needed adjustments with dial indicator, how to adjust as necessary with shims and adjusting nuts, and how to reassemble gear set and adjust to specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study the power train section of the appropriate shop manual (I & T) or manufacturer's service manual for the designated tractor in order to determine the preload specifications.

2. Respond to the following

   a. Define preload adjustment.
   b. When are gear trains reloaded?
   c. What will happen if bearings are preloaded too tightly?
   d. What items are used to preload gear drives?

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A gear train which needs preloading, manufacturer's service manual, shims, a dial indicator, and necessary tools.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATIONS: PREVENTIVE MAINTENANCE. John Deere Company, Moline, IL. Page 195. 1973.

FUNDAMENTALS OF SERVICE; POWER TRAINS. John Deere Company, Moline, IL. Pages 1-20. 1969.

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

3.0 **COMPETENCY/SKILL:** Inspects bearings, gears and surfaces for excess wear and clearance.

3.5 **TASK:** Checks gear mesh with Prussian blue.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: check gear mesh with Prussian blue die on designated tractor.

STANDARD: Demonstrate the use of Prussian blue die to check gear mesh on transmission. Reassembled transmission will operate according to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the use of Prussian blue die to coat metal when checking the contact area of precision machined parts.

2. Use Prussian blue die to coat and check contact area of gear mesh when servicing transmission.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Review an instruction manual for proper use of Prussian blue die.

2. Following a demonstration, have students check gear mesh of transmission on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Tractor, service manual, mechanic's tool set, needed parts and equipment.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

3.0 **COMPETENCY/SKILL:** Inspects bearings, gears, and surfaces for exess wear and clearance.

3.6 **TASK:** Checks gear backlash.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a gear with too much backlash, a dial indicator, shims, service manual, and necessary tools,

EVALUATION: measure the backlash and clearance in a gear train.

STANDARD: Measure the backlash and clearance in a gear train so that the dial indicator readings agree with those of the instructor. Shims should be correctly installed and final adjustment must be to specifications.

STUDENT LEARNING EXPERIENCES:

1. Use proper safety precautions.
2. Discuss how to follow disassembly instruction in manufacturer's service manual.
3. Demonstrate how to clean all parts.
4. Demonstrate how to mount a dial indicator on the gear so it registers the full rotary movement of the gear.
5. Demonstrate how to adjust backlash reading to specification with shims.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study the power train section of the appropriate shop manual (I & T) or the manufacturer's service manual for the designated tractor in order to determine breakdown procedure and backlash specifications.

2. Respond to the following:

   a. What is backlash?
   b. What are three things that cause backlash?
   c. What will result from too much backlash?

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A gear train with too much backlash, dial indicator, shims, service manual, necessary tools and equipment.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATIONS: PREVENTIVE MAINTENANCE. John Deere Company, Moline, IL. Page 194. 1973.

FUNDAMENTALS OF SERVICE; POWER TRAINS. John Deere Company, Moline, IL. Pages 1-20. 1969.

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

4.0 **COMPETENCY/SKILL:** Installs gaskets, O-rings and seals on systems to control leakage of fluids and prevent damage.

4.1 **TASK:** Removes gaskets, O-rings and seals.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, replacement parts, and hydraulic oil,

EVALUATION: remove gaskets, O-rings and seals on defective part on designated tractor's hydraulic system.

STANDARD: The gaskets, O-rings and seals must be replaced so that the repaired parts do not leak under operating pressure.

STUDENT LEARNING EXPERIENCES:

1. Discuss shop safety procedures.
2. Identify defective part.
3. Discuss when it is necessary to install gaskets, O-rings and seals on faulty parts.
4. Demonstrate how to remove gaskets, O-rings and seals.
5. Demonstrate how to replace gaskets, O-rings and seals on designated part.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Replace gaskets, O-rings and seals on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Tractor, service manual, mechanic's tool set, replacement parts, and hydraulic oil.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Educational Service, Department of Education, Richmond, VA. 1983.

4.0 **COMPETENCY/SKILL:** Installs gaskets, O-rings and seals on systems to control leakage of fluids and prevent damage.

4.2 **TASK:** Utilizes lubricants and sealing compounds.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, needed parts and supplies, and hydraulic oil,

EVALUATION: utilize lubricants and sealing compounds servicing/repairing defective part on designated tractor's hydraulic system.

STANDARD: The lubricants and sealing compounds must be applied in accordance with manufacturer's recommendations. The repaired part must not leak under operating pressure.

STUDENT LEARNING EXPERIENCES:

1. Discuss shop safety procedures.
2. Identify defective part.
3. Discuss when it is necessary to utilize lubricants and sealing compounds repairing broken parts.
4. Demonstrate how to utilize lubricants and sealing compounds servicing/repairing defective part on designated tractor's hydraulic system.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Utilize lubricants and sealing compounds repairing defective part on designated tractor's hydraulic system.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Tractor, service manual, mechanic's tool set, lubricants, sealing compounds, hydraulic oil, needed parts and supplies.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Educational Service, Department of Education, Richmond, VA. 1983.

4.0 **COMPETENCY/SKILL:** Installs gaskets, O-rings and seals on systems to control leakage of fluids and prevent damage.

4.3 **TASK:** Adjusts fitting torque.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a new fitting, mechanic's tool set, replacement parts, service manual, and hydraulic oil,

EVALUATION: replace the hydraulic fitting.

STANDARD: Adjust fitting torque to manufacturer's specifications. The hydraulic fitting must be replaced so that it does not leak under operating pressure.

STUDENT LEARNING EXPERIENCES:

1. Discuss shop safety procedures.
2. Identify faulty fitting.
3. Discuss how to check threads, flanges, and flairs for burns or nicks which could cause damage to new filter.
4. Demonstrate how to install a fitting to the correct angle and how to tighten the lock nut drum.
5. Demonstrate how to tighten the line, making sure that the sealing flange does not turn.
6. Demonstrate how to replace the hydraulic fitting.
7. Torque fitting to manufacturer's specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Replace the hydraulic fitting and torque fitting to specifications on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. New hydraulic fitting, service manual, mechanic's tool set, replacement parts, and hydraulic oil.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Educational Service, Department of Education, Richmond, VA. 1983.

4.0 **COMPETENCY/SKILL:** Installs gaskets, O-rings, and seals on systems to control leakage of fluids and prevent damage.

4.4 **TASK:** Selects replacement parts.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, replacement parts,

EVALUATION: select replacement part for hydraulic fitting.

STANDARD: The selected replacement part must meet manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss shop safety procedures.
2. Identify faulty fitting.
3. Discuss how to select replacement parts.
4. Reference service manual for part number and size specified by manufacturer.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Select replacement parts for designated tractor's hydraulic system.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, and replacement parts.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Educational Service, Department of Education, Richmond, VA. 1983.

4.0 **COMPETENCY/SKILL:** Installs gaskets, O-rings and seals on systems to control leakage of fluids and prevent damage.

4.5 **TASK:** Installs replacement parts.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, replacement parts, and hydraulic oil,

EVALUATION: install replacement parts.

STANDARD: The installed replacement parts must be in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss shop safety procedures.
2. Identify faulty part.
3. Discuss how to select replacement part.
4. Discuss how to check threads, flanges, and flairs for burns or nicks which could cause damage to new filter.
5. Discuss when it is necessary to install O-ring on fitting.
6. Demonstrate how to install replacement part.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Select replacement parts for designated tractor's hydraulic system.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, and replacement parts, and hydraulic oil.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Educational Service, Department of Education, Richmond, VA. 1983.

5.0 **COMPETENCY/SKILL:** **Reads and interprets parts manuals/microfiche to access/order needed parts for servicing/repairing.**

5.1 **TASK:** Locates model-serial numbers.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given unmarked parts recently received, unmarked parts stored in bins, a packing slip, a parts catalog, blank tags, and a microfishe file,

EVALUATION: complete parts identifications using model-serial numbers and stock numbers.

STANDARD: All parts must be securely tagged with the correct catalog number, as determined by the catalog or microfiche.

STUDENT LEARNING EXPERIENCES:

1. Discuss the parts identification numbering system for the parts department.
2. Demonstrate how to tag all unmarked parts.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Review a parts numbering system.
2. Tag parts according to a numbering system.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Unmarked parts, packing slips, parts catalog, blank tags, and a microfiche file

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

5.0 **COMPETENCY/SKILL:** Reads and interprets parts manuals/microfiche to access/order needed parts for servicing/repairing.

5.2 **TASK:** Locates reference/figure number of parts.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a parts catalog and a situation in which a customer requests three parts,

EVALUATION: determine the parts numbers from the catalog.

STANDARD: The correct number must be determined for each part according to information received from customer.

STUDENT LEARNING EXPERIENCES:

1. List the information needed to determine part of concern.
2. Demonstrate how to use the parts catalog that corresponds to the type of machine for which the part is needed.
3. Demonstrate how to determine the part number.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Play the parts of customer and salesperson.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A parts catalog.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

5.0 **COMPETENCY/SKILL:** Reads and interprets parts manuals/microfiche to access/order needed parts for servicing/repairing.

5.3 **TASK:** Identifies part numbers.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a microfiche file and viewer and a situation in which a customer requests a part,

EVALUATION: determine the part number from the microfiche.

STANDARD: The correct part number must be determined.

STUDENT LEARNING EXPERIENCES:

1. Secure necessary information needed to determine part of concern.
2. Demonstrate how to use a microfiche file to locate part number from the microfiche file that corresponds to the type of machine for which the part is needed.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Role play the parts of a customer and salesperson.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A microfiche file and viewer

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

5.0 **COMPETENCY/SKILL:** Reads and interprets parts manuals/microfiche to access/order needed parts for servicing/repairing.

5.4 **TASK:** Cross references part number update.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a parts catalog, price book, and parts bulletin containing the single page inserts,

EVALUATION: update parts numbers and prices.

STANDARD: All the outdated pages must be removed and destroyed, and all new pages inserted in the proper sequence in the catalog and price book.

STUDENT LEARNING EXPERIENCES:

1. Identify the outdated parts and prices.
2. Compare the remaining inserts with corresponding pages in the parts catalog or price book.
3. Demonstrate how to destroy all outdated pages.
4. Discuss the procedure for replacing all outdated pages in the parts catalog.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Compare the remaining inserts with corresponding pages in parts catalog or price book.
2. Indicate the outdated pages which should be replaced in old parts catalog.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A parts catalog, price book, and parts bulletin containing the single page inserts.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

5.0 **COMPETENCY/SKILL:** Reads and interprets parts manuals/microfiche to access/order needed parts for servicing/repairing.

5.5 **TASK:** Locates parts from stock.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a list of parts needed in the service shop, a blank work-order, price list, and parts catalog or microfiche file,

EVALUATION: supply parts to a service shop.

STANDARD: Supply the parts to a service shop in such a manner that all requested parts are delivered to the service shop and work-order is completed.

STUDENT LEARNING EXPERIENCES:

1. Determine parts needed from the service manager or mechanic.
2. Demonstrate how to use a parts catalog or microfiche file to determine the storage bin locations, prices, and numbers of parts, and record this information on the parts list.
3. Demonstrate how to secure parts from storage bins.
4. Demonstrate how to bill the parts obtained from the bins on the service work order.
5. Deliver the parts and work order to the service manager or mechanic.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Obtain necessary information from mechanic.
2. Determine bin locations, prices, and numbers of parts.
3. Secure parts from storage bins.
4. Prepare work order and deliver parts to mechanic.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A blank work-order, price list, and parts catalog or a microfiche file

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

5.0 **COMPETENCY/SKILL:** Reads and interprets parts manuals/microfiche to access/order needed parts for servicing/repairing.

5.6 **TASK:** Lists parts on service orders.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given sales slip, rubber stamps and a setting in which a customer is making a purchase,

EVALUATION: fill out a sales slip (work-order) for the purchase.

STANDARD: The sales slip (work-order) must be legible, filled in accurately and completely, and void of any mathematical errors.

STUDENT LEARNING EXPERIENCES:

1. Discuss department regulations for making out sales slip (work-order).
2. Demonstrate how to complete a sales slip (work-order).

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study and discuss department regulations for filling out sales slips (work-orders) from several local firms.
2. Complete sales slips (work-orders) for several specific transactions.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A sales slip and rubber stamp

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

6.0 **COMPETENCY/SKILL:** Operates Microcomputers/Terminals to access computerized inventory of parts.

6.1 **TASK:** Accesses parts manuals/microfiche for parts number.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a microfiche file and viewer and a situation in which a customer requests several parts,

EVALUATION: determine the parts numbers from the microfiche.

STANDARD: The correct parts number must be determined for each part requested.

STUDENT LEARNING EXPERIENCES:

1. Secure necessary information needed to determine part.
2. Demonstrate how to use a microfiche file to locate part number from the microfiche file that corresponds to the type of machine for which the part is needed.
3. Demonstrate how to determine the part number.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Role play the parts of a customer and salesperson.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A microfiche file and viewer

RESOURCES:

Walker, Hattie M. et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

6.0 **COMPETENCY/SKILL:** Operates Microcomputers/Terminals to access computerized inventory of parts.

6.2 **TASK:** Accesses inventory by computer code.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a list of new parts, computer terminal, and a computer inventory print-out,

EVALUATION: add/delete parts to a computer inventory system.

STANDARD: All added/deleted items will be entered into the system by accessing inventory using proper code.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate how to record new parts information on the "new parts" sheet.
2. Demonstrate how to delete obsolete parts or items no longer stocked.
3. Demonstrate how to place the new parts in the storage bin identified on the "new parts" sheet.
4. Demonstrate how to remove obsolete parts from the storage bin for disposal.
5. Demonstrate how to access inventory by proper code and enter all changes in the inventory.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Record a list of new parts on a "new parts" sheet.
2. Record a list of deletions on a "deleted parts" sheet.
3. Shelve new parts according to "new parts" sheet.
4. Remove from bin deleted parts according to "deleted parts" sheet.
5. Using a computer terminal, have students access inventory and enter changes in the inventory.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A list of new parts, computer terminal, and a computer inventory print-out.

RESOURCES:

Walker, Hattie M. et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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6.0 **COMPETENCY/SKILL:** Operates Microcomputers/Terminals to access computerized inventory of parts.

6.3 **TASK:** Orders parts from inventory.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an order provided by computer print-out,

EVALUATION: order the parts needed by parts department.

STANDARD: Verification of the parts listed on the order must be based on the computer print-out.

STUDENT LEARNING EXPERIENCES:

1. Obtain the computer parts order which accompanies the updated inventory print-out and review the computer parts order to make any necessary changes.
2. Demonstrate how to send a copy of the computer parts order form to the warehouse, retaining one copy for parts department files.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Review a computerized order.
2. Prepare a computerized order form and process for distribution to warehouse.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A computer print-out order, and a computer terminal

RESOURCES:

Walker, Hattie M. et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

7.0 **COMPETENCY/SKILL:** Calibrates agricultural power and machinery for optimal use in agricultural operations.

7.1 **TASK:** Aligns electronic seed monitor instrument.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given operator's manual, a planter attached to tractor,

EVALUATION: align electronic seed monitor instrument.

STANDARD: The electronic seed monitor and planter must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of farm machinery operation.
2. Discuss the function and importance of the electronic seed monitor instrument's alignment to the planting operation.
3. Calibrate the planter for planting accuracy.
4. Compute .02-acre of planting population. The seed monitor instrument will show each row planted in sequence, row one, two, three, and four, monitor must show computed planting population.
5. If unit malfunctions, check for blockage in affected planter. Retest system and re-align planter unit.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Compute planting population of different types of seed.
2. Read appropriate section of FUNDAMENTALS OF MACHINE OPERATION: PLANTING.
3. Following demonstration, have students troubleshoot electronic seed monitor system.
4. Following demonstration, have students align electronic seed monitor instrument on designated equipment.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, and a planter attached to tractor

RESOURCES:

Walker, Hattie M. et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

7.0 **COMPETENCY/SKILL:** Calibrates agricultural power and machinery for optimal use in agricultural operations.

7.2 **TASK:** Adjusts machines for seed drop.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given operator's manual, a planter attached to tractor,

EVALUATION: adjust machine for seed drop rate.

STANDARD: The planter seed drop rate must be in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of farm machinery operation.
2. Demonstrate how to adjust and operate the planter according to operator's manual.
3. Field adjust seed drop rate.
4. Adjust depth of planting.
5. Explain field calibration of planter.
6. Explain planting speed, and check planter travel speed.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read appropriate section of FUNDAMENTALS OF MACHINE OPERATION: PLANTING.
2. Following demonstration, have students determine seed drop rate.
3. Following demonstration, have students field adjust seed drop rate on designated planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, and a planter attached to tractor

RESOURCES:

Walker, Hattie M. et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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7.0 **COMPETENCY/SKILL:** Calibrates Agricultural power and machinery for optimal use in agricultural operations.

7.3 **TASK:** Selects type of chemical spray nozzle.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given operator's manual, mechanic's tool set, a chemical sprayer system,

EVALUATION: select type of a chemical spray nozzle.

STANDARD: Selected spray nozzle must be calibrated and operate in accordance with recommended specifications for type of chemical to be applied.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of farm machinery operation.
2. Discuss the safety aspects of agricultural chemical application operations.
3. Discuss the safe handling and storage of agricultural chemicals.
4. Discuss applicable rules and regulations that govern the use of agricultural chemicals.
5. Discuss the basic functions of sprayers.
6. Discuss sprayer types and components.
7. Demonstrate selecting a sprayer and nozzle for optimal application.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following demonstration, have students identify chemical sprayer components.
2. Following demonstration, have students discuss safe handling and storage of agricultural chemicals.
3. Following demonstration, have students select type of chemical spray nozzle for designated sprayer.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, mechanic's tool set, and chemical sprayer system.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: CROP CHEMICALS. Deere and Company, Moline, IL. 1976.

7.0 **COMPETENCY/SKILL:** Calibrates agricultural power and machinery for optimal use in agricultural operations.

7.4 **TASK:** Sets distribution rate.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given operator's manual, a planter attached to tractor,

EVALUATION: set seed distribution rate.

STANDARD: Seed distribution rate must be in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of farm machinery operation.
2. Discuss planter components.
3. Explain how to determine seed spacing ratio.
4. Explain how to change seed spacing on most row-crop planters by changing to different sizes of drive and driven sprockets.
5. Discuss the relationship of tire size to calibration table used to determine distribution rate.
6. Explain the importance of air pressure in the tire which may cause variation in planting rate.
7. Discuss drive wheel slippage. Explain the varying conditions which may cause the drive wheels to slip.
8. Set distribution rate on planter.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following demonstration, have students determine seed spacing ratio.
2. Following demonstration, have students identify planter components.
3. Following demonstration, have students set distribution rate on designated planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, and a planter attached to tractor

RESOURCES:

Walker, Hattie M. et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

7.0 **COMPETENCY/SKILL:** Calibrates agricultural power and machinery for optimal use in agricultural operations.

7.5 **TASK:** Adjusts orifice size.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given operator's manual, mechanic's tool set, a chemical sprayer system,

EVALUATION: adjust orifice size.

STANDARD: Adjusted orifice must be calibrated and operate in accordance with recommended specifications for type chemical to be applied.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of farm machinery operation.
2. Discuss the safety aspects of agricultural chemical application operations.
3. Discuss the safe handling and storage of agricultural chemicals.
4. Discuss applicable rules and regulations that govern the use of agricultural chemicals.
5. Discuss the basic functions of sprayers.
6. Discuss sprayer types and components.
7. Demonstrate sprayer calibration procedures.
8. Adjust sprayer orifice size for optimal chemical application.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following demonstration, have students identify chemical sprayer components.
2. Following demonstration, have students discuss safe handling and storage of agricultural chemicals.
3. Following demonstration, have students calibrate designated sprayer.
4. Following demonstration, have students adjust orifice size on designated sprayer.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, mechanic's tool set, a chemical sprayer system

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: CROP CHEMICALS. Deere and Company, Moline, IL. 1976.

7.0 **COMPETENCY/SKILL:** Calibrates agricultural power and machinery for optimal use in agricultural operations.

7.6 **TASK:** Selects plate and drum size.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given operator's manual, a planter equipped with an air metering device, and mechanic's tool set,

EVALUATION: select plate and drum size.

STANDARD: Selected plate and drum size must operate and be in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of farm machinery operation.
2. Discuss planter components.
3. Discuss the method used in selecting plate and drum size.
4. Discuss planting accuracy if a pressurized metering drum when compared to other types of planters.
5. Install selected plate and drum.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following demonstration, have students identify planter components.
2. Following demonstration, have students select plate and drum size for designated planter.
3. Install plate and drum on designated planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, a planter equipped with an air metering device, and mechanic's tool set.

RESOURCES:

Walker, Hattie M. et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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7.0 **COMPETENCY/SKILL:** Calibrates agricultural power and machinery for optimal use in agricultural operations.

7.7 **TASK:** Selects drive sprocket size.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given operator's manual, row-crop planter, and mechanic's tool set,

EVALUATION: select drive sprocket size.

STANDARD: Selected drive sprocket size must be in accordance with recommended seeding rate and meet manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of farm machinery operation.
2. Discuss planter components.
3. Explain how to determine drive sprocket size.
4. Discuss the ratio of the speed of the metering mechanism to the forward travel speed in determining seed spacing in the row.
5. Install the proper combination of sprockets on the drive and drive shafts to adjust the speed ratio.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following demonstration, have students identify planter components.
2. Following demonstration, have students determine drive sprocket size.
3. Following demonstration, have students install the proper combination of sprockets on the drive and driven shafts to adjust the speed ratio on designated planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, row-crop planter, and mechanic's tool set

RESOURCES:

Walker, Hattie M. et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

7.0 **COMPETENCY/SKILL:** Calibrates agricultural power and machinery for optimal use in agricultural operations.

7.8 **TASK:** Sets harvesting efficiency of a combine.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given operator's manual, needed tools, a combine harvester,

EVALUATION: set harvesting efficiency.

STANDARD: Combine harvesting efficiency must be adjusted and operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of agricultural machinery operation.
2. Discuss the economics of combine harvesting efficiency.
3. Discuss operating properly in field.
4. Discuss the "General Rules for Good Combining".
5. Demonstrate operating and adjusting cutting and feeding units.
6. Demonstrate operating and adjusting threshing units.
7. Demonstrate operating and adjusting cleaning units.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following demonstration, have students identify combine harvester components.
2. Following demonstration, have students set harvesting efficiency on designated combine.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, needed tools, and combine harvester

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: COMBINE HARVESTING. Deere and Company, Moline, IL. 1973.

7.0 **COMPETENCY/SKILL:** Calibrates agricultural power and machinery for optimal use in agricultural operations.

7.9 **TASK:** Sets power shaft rpm.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set,

EVALUATION: set power shaft rpm on designated planter.

STANDARD: Power shaft rpm must be in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing planter.
2. Discuss the importance of proper power shaft rpm setting.
3. Reference manual for recommended power shaft rpm setting.
4. Set power shaft rpm on designated planter.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students set power shaft rpm on designated planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, and planter

RESOURCES:

Walker, Hattie M. et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

7.0 **COMPETENCY/SKILL:** Calibrates agricultural power and machinery for optimal use in agricultural operations.

7.10 **TASK:** Adjusts hitch to specifications.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given operator's manual, and planter,

EVALUATION: attach planter and adjust hitch on designated tractor.

STANDARD: Adjust hitch to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of farm machinery operation.
2. Demonstrate attaching planter to tractor and adjust hitch.
3. Inspect planter for worn or broken parts.
4. Use installed jack on planter to raise or lower the planter hitch.
5. Position lower and upper pins and spacers for tractor's category of hitch.
6. Align tractor draft links with the lower hitch pins.
7. Connect the draft links.
8. Adjust the right lift link.
9. Adjust the upper link to reach the mast.
10. Attach the upper link.
11. Raise the parking stand to the transport position.
12. Adjust hitch to operating level.

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SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students perform pre-operation inspection on tractor.
2. Following a demonstration, have students inspect designated implement prior to attaching to tractor.
3. Following a demonstration, have students attach implement and adjust hitch on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, planter, and tractor

RESOURCES:

Walker, Hattie M. et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

7.0 **COMPETENCY/SKILL:** Calibrates agricultural power and machinery for optimal use in agricultural operations.

7.11 **TASK:** Inflates transport wheel tires to specifications.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, tire gauge, air compressor,

EVALUATION: inflate transport wheel tires on designated planter.

STANDARD: Transport wheel tires must be inflated to specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing planter.
2. Discuss the importance of tire inflation to planter operation.
3. Refer to manual for recommended tire inflation pressure.
4. Inflate tires to specified pressure.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Have students read the sections of FUNDAMENTALS OF MACHINE OPERATION: PLANTING on transport wheel tires.
2. Following a demonstration, have students check transport wheel tires inflation pressure on designated planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, tire gauge, air compressor, and planter

RESOURCES:

Walker, Hattie M. et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.1 **TASK:** Operates fuel testing equipment.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, and an injector nozzle tester,

EVALUATION: demonstrate the use and a knowledge of the need for the information gained by equipment use.

STANDARD: The designated tractor's fuel system measurements and test results should concur with those of the instructor.

STUDENT LEARNING EXPERIENCES:

1. Discuss safety precautions to use when servicing/repairing agricultural power and machinery fuel systems.
2. Discuss the recommended specifications for fuel system being serviced.
3. Demonstrate how to use an injector nozzle tester.
4. Test opening pressure.
5. Test spray pattern.
6. Test for valve leakage.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Review FUNDAMENTALS OF SERVICE: SHOP TOOLS.
2. Operate injector nozzle tester.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, an injector nozzle tester, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.2 **TASK:** Locates malfunctioning components.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, needed equipment,

EVALUATION: locate malfunctioning components.

STANDARD: The identified malfunctions must concur with those of the instructor.

STUDENT LEARNING EXPERIENCES:

1. Discuss safety precautions to use when servicing/repairing agricultural power and machinery fuel systems.
2. Discuss the recommended specifications for fuel system being serviced.
3. Discuss procedure to perform a visual inspection, usually before a tractor is cleaned.
4. Discuss instrument testing and how to interpret results, or measurements.
5. Discuss instruments used for testing engine performance.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the cycles of internal combustion engines (diesel and gasoline).
2. Identify the components and systems of internal combustion units.
3. Discuss how changes in individual components and systems affect engine efficiency.
4. Identify the various types of testing equipment and discuss their specific use to identify problem areas.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.3 **TASK:** Rebuilds carburetor.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an assorted set of end wrenches, a service manual, screwdrivers, needle nose pliers, carburetor cleaner, and a dynamometer,

EVALUATION: install a carburetor repair kit on the designated tractor.

STANDARD: The engine should run at service manual specifications. There should be no fuel leaks in the carburetor, with engine stopped, while idling, or under load. The actual work time should not exceed 1-1/2 hours, excluding time parts are in cleaning solution.

STUDENT LEARNING EXPERIENCES:

1. Turn off fuel supply and remove carburetor from engine.

2. Remove screws from top of carburetor; remove carburetor float, needle, seat, and gasket from top half of carburetor.

3. Place the top and bottom halves of the carburetor into a can of carburetor-cleaning solution. Let stand for at least four hours.

4. Remove carburetor from cleaning solution and wash thoroughly with very hot water.

5. Take air hose and blow remaining water from the parts. Be sure to blow into all holes and corners.

6. Remove each jet (one-at-a-time) and replace with a new one. Remove throttle shaft and bushings and replace with new one. Follow the same procedure for the remaining new parts. After all new parts have been installed and float height adjusted, reassemble carburetor.

7. With carburetor reassembled, installed on engine, start engine and let run until reaching normal operationg temperature. Make a final idle adjustment.

8. To set load adjustment, put tractor on dynamometer and set load screw to specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the instructions accompanying the carburetor repair kit.

2. Install a carburetor repair kit on the assigned tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, an assorted set of end wrenches, screwdrivers, needle nose pliers, carburetor cleaner, dynamometer, and a tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

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8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.4 **TASK:** Installs fuel line.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the necessary tools,

EVALUATION: clean and install fuel lines of an engine.

STANDARD: Remove and clean the fuel lines on a gasoline engine so that the fuel flows freely from the tank to the carburetor. The task must be completed within 10% of the time stated in a flat rate manual.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of handling gasoline.
2. Discuss the fuel requirements of small engines.
3. Identify the causes of fuel stoppage in small engines.
4. Discuss the procedures in troubleshooting fuel systems of various types of small engines.
5. Troubleshoot, remove, and clean a fuel system for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate how to remove and clean fuel lines.
2. Troubleshoot a plugged fuel system.
3. Remove and clean a small engine fuel system.
4. Participate in a discussion of the fuel requirement of small engines.
5. Show slides on repair of small engines.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Necessary tools, and a small gasoline engine.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.5 **TASK:** Installs fuel line boots.

PERFORMANCE OBJECTIVE:

See Task 8.12.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.6 **TASK:** Replaces bleedline screen.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, replacement parts, and clean rags,

EVALUATION: replace bleedline screen on designated tractor.

STANDARD: There will be no dirt in the settling bulb (sediment bowl) and no leaks in the fuel valve, settling bulb, or fuel line connections.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper safety precautions when servicing/repairing fuel systems on agricultural power equipment.
2. Demonstrate how to follow service manual procedures for servicing the fuel system.
3. Drain all fuel from the fuel line.
4. Remove settling bulb and screen.
5. Clean settling bulb, install new screen and replace.

   NOTE: Some carburetors will have a screen at the point where the fuel line connects to the carburetor. Lossen the fitting into the carburetor and remove it. The screen will be attached to this fitting.

6. Connect fuel line. Check for leaks.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the following:

   A. Describe the procedure used in cleaning the sediment bowl and fuel filter.

   B. What is the difference between a disk filter and a screen filter?

   C. What should you use to clean a filter?

2. With the help of the Student Learning Task replace the bleedline screen on the assigned tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, clean rags, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.7 **TASK:** Replaces check valve.

PERFORMANCE OBJECTIVE:

See Task 8.3.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.8 **TASK:** Adjusts throttle.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, and mechanic's tool set,

EVALUATION: adjust throttle on designated tractor.

STANDARD: When carburetor is properly adjusted, the engine will run smoothly and no black smoke will come from the exhaust.

STUDENT LEARNING EXPERIENCES:

1. Discuss the procedure for adjusting throttle.
2. Check engine air cleaner and make sure that the engine can get clean, nonrestricted air.
3. Start engine and let warm up to normal operating temperature.
4. Turn idle adjustment screw in until the engine begins to run irregulary.
5. Turn the screw in the opposite direction until engine once again runs irregularly.
6. Turn the screw clockwise and counter clockwise until engine begins to run smoothly.
7. Advance the throttle two or three times and then let the engine return to idle speed.
8. Check setting with tachometer.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read reference and complete the following questions:

    A. Name four steps you would use when adjusting the idling air mixture if a dwell tachometer is not available.
    B. Identify the following items on a carburetor.
        1. Idle-speed adjustment.
        2. High-speed load adjustment.
        3. Drain plug.
    C. What does the idle mixture adjusting screw do? Explain the affect on engine operation when the idle mixture adjusting screw is turned in/or out.
    D. If the engine operation is not affected by one or two complete turns of the adjusting screw what might be the problem?
    E. Air/fuel mixtures adjusted too lean may result in damaged ________________________.

2. With the help of the Student Learning Tasks, adjust the throttle.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.9 **TASK:** Repairs throttle.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given malfunctioning throttle, bending pliers, and manufacturer's specifications,

EVALUATION: repair throttle cable on a lawn mower.

STANDARD: Repair throttle cable on a lawn mower engine so tht it opens the throttle fully and closes to idle speed without binding.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of replacing a throttle cable on a mower.
2. List the steps in troubleshooting a throttle cable assembly.
3. Discuss the procedures as outlined in service manuals for replacing throttle cables.
4. Demonstrate how to adjust a cable for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate how to replace and adjust a throttle cable.
2. Remove and inspect throttle cable assembly.
3. Troubleshoot a throttle cable assembly.
4. Install and adjust a throttle cable.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Bending pliers, manufacturer's specification, and lawn mower.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.10 **TASK:** Replaces (installs) throttle.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given throttle cable, bending pliers, and manufacturer's specifications,

EVALUATION: replace throttle cable on a lawn mower.

STANDARD: Replace throttle cable on a lawn mower engine so that it opens the throttle fully and closes to the idle speed without binding.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of replacing a throttle cable on a mower.
2. List the steps in troubleshooting a throttle cable assembly.
3. Discuss the procedures as outlined in service manuals for replacing throttle cables.
4. Demonstrate how to adjust a cable for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate how to replace and adjust a throttle cable.
2. Remove and inspect a throttle cable assembly.
3. Troubleshoot a throttle cable assembly.
4. Install and adjust a throttle cable.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A new throttle cable, bending pliers, manufacturer's specifications, and lawn mower.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.11 **TASK:** Replaces gasket and O-ring of fuel system.

PERFORMANCE OBJECTIVE:

See Task 8.15.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.12 **TASK:** Sets timing of injection pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a tractor engine, necessary wrenches, and service manuel,

EVALUATION: time the fuel injector pump on the engine.

STANDARD: The fuel injector pump will be timed to within one-half degree of the instructor's reading and the specifications given in the service manual.

STUDENT LEARNING EXPERIENCES:

1. Check manufacturer's specifications for timing of make and model of tractor. (Information below is for a Robert Bosch in-line fuel injector pump.)
2. Remove No. 1 injector and make sure cylinder is on compression stroke.
3. Rotate engine until timing mark on flywheel is correct and timing line on pump gear drive can be seen in timing plug hole.
4. Align pump timing mark and rotate the pump gear counter clockwise approximately one tooth so that gears will match correctly when pump is installed.
5. Install pump and install retaining cap screws lightly.
6. Rotate pump in slotted holes to align timing marks exactly and tighten cap screws to recommended torque.
7. Install lines and controls to pump.
8. Bleed fuel system.
9. Start engine and check for leaks.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on timing for fuel injection pump in the I & T SHOP MANUAL for the designated tractor.
2. Practice timing a fuel injector pump on the designated tractor. Use the procedure in the Student Learning Tasks.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A tractor engine, necessary wrenches, and service manual.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.13 **TASK:** Adjusts injection pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given appropriate wrenches, a strobelight tachometer and other special tools for checking timing for injection pump,

EVALUATION: service a diesel-injection pump for minor adjustments.

STANDARD: Timing must be set to manufacturer's specifications. High and low idle, as checked by the instructor, must be within 5% of the manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the manufacturer's specifications for an engine at high idle, low idle, and basic engine timing.
2. Explain how to rotate the engine until the correct degree of timing comes up at the fly wheel or front pulley.
3. Discuss how to tighten the pump bolts and start the engine.
4. With a strobe tachometer, demonstrate how to take a reading of the engine rpm at low idle and compare with the specifications.
5. Explain how to rotate the low-idle stop of the governor control until the correct low idle is reached.
6. Demonstrate how to operate the engine at high idle and check for loose fittings and leaky lines.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Consult a manufacturer's service manual and service the designated injection pump for minor adjustments.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Appropriate wrenches, strobelight tachometer, other special tools, service manual, and diesel powered tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.14 **TASK:** Replaces injection pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given appropriate wrenches, a strobelight tachometer and other special tools to check timing for the injection pump,

EVALUATION: replace diesel-injection pump.

STANDARD: The replaced diesel-injection pump's timing will be set to manufacturer's specifications. High and low idle, as checked by the instructor, will be within 5% of the manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Check the manufacturer's specifications for the engine at high idle, low idle, and basic engine timing.

2. Rotate the engine until the correct degree of timing comes up at the flywheel or front pulley.

3. Remove the plug at the pump or the plate on the pump to see if the timing marks are in line.

4. If timing marks are not in line, loosen retaining bolts and rotate the pump clockwise or counter clockwise until the marks are exactly in line.

5. Tighten the pump bolts and start the engine.

6. With a strobe tachometer, take a reading of the engine rpm at low idle, compare with specifications.

7. Rotate the low-idle stop of the governor control until the correct low idle is reached.

8. Move the fuel control lever to high idle and compare the tachometer reading with the manufacturer's specifications.

9. Move the high-idle adjustment screw until the manufacturer's recommended setting is reached and lock down with jam nuts. Install a locking wire to prevent further movement.

10. Operate the engine at high idle and check for loose fittings and leaky lines.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Using the Student Learning Tasks and the manufacturer's service manual, service the designated diesel-injection pump, remove, replace and adjust to manufacturer's specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Replacement parts, service manual, appropriate wrenches, strobelight tachometer, other special tools, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

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8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.15 **TASK:** Replaces primer of fuel transfer pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a Roosa-Master Service Manual, screwdrivers, a micrometer, and a torque wrench,

EVALUATION: service the diesel-transfer pump on the designated tractor.

STANDARD: The removal and reinstallation will meet Roosa-Master specifications for its fuel transfer pump. The job will take no more than one hour.

STUDENT LEARNING EXPERIENCES:

1. Clean work and pump area completely.
2. Remiove hydraulic head assembly.
3. Remove end plate.
4. Remove end-plate seal located on top of the end-plate sleeve with a dull scribe.
5. Remove sleeve with a Roosa-Master tool #1704. Use rotary motion to prevent damage of O-ring seal sleeve.
6. Remove priming by-pass spring at bottom of sleeve bore.
7. Remove transfer pump seal O-ring.
8. Remove transfer pump liner from pump. Remove pump blades, being careful not to lose any attached springs.
9. Wash transfer pump in clean fuel oil.
10. Check pump liner and blades for scratches which could cause problems.
11. If blades are unbroken, measure with micrometer (minimum width is "1.0930"). If width is incorrect, replace both blades.
12. Insert priming by-pass spring into end plate.
13. Place plunger in end-plate sleeve and shake to be sure plunger is free to move in bore.
14. Using twisting motion to prevent seal damage insert sleeve into end plate with Roosa-Master tool #1704.

15. Assemble regulating spring in bore; install end-plate plug and tighten.

16. Wash transfer pump liner and place in position.

17. Insert blades carefully with one vertical and the other horizontal.

18. Install end-plate sealing ring.

19. Turn liner so notched slot will align with roll pin in end-plate assembly. Install end-plate assembly.

20. Insert screws and tighten to 36-39 in. - lbs.

21. Reinstall fuel lines and bleed system.

22. Check fuel pump pressure if problems exist. (Should not exceed 130 lbs. and should be a minimum of 18-22 PSI at 225 pump RPM).

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Complete the following:

   A. What is the purpose of a diesel transfer pump?
   B. List two basic types of fuel transfer pumps.
   C. What usually causes diesel transfer pumps to breakdown?

2. Using the Student Learning Tasks and the Roosa-Master service manual, service/repair the diesel transfer pump.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A Roosa-Master service manual, screwdrivers, micrometer, torque wrench, and a Roosa-Master tool #1704.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.16 **TASK:** Services/repairs/replaces fuel transfer pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a Roosa-Master service manual, screwdrivers, a micrometer, and a torque wrench,

EVALUATION: service the diesel transfer pump on the designated tractor.

STANDARD: The removal and reinstallation must meet Roosa-Master specifications for its fuel transfer pump. The job should take no longer than one hour.

STUDENT LEARNING EXPERIENCES:

1. Discuss the purpose of a diesel-transfer pump.

2. List two basic types of fuel transfer pumps.

3. Discuss what usually causes diesel-transfer pumps to break down.

4. Demonstrate how to perform the sequenced procedure for servicing a diesel-transfer pump.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Respond to the following:

   a. What is the purpose of a diesel-transfer pump?
   b. List two basic types of fuel transfer pumps.
   c. What usually cause diesel-transfer pumps to break down?

3. Consult the Roosa-Master service manual and service the diesel-transfer pump.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Roosa-Master service manual, screwdrivers, micrometer, torque wrench, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.17 **TASK:** Replaces fuel filters.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operator's manual, replacement filters and gaskets, clean rags and suitable wrenches,

EVALUATION: service the diesel fuel filter on the designated tractor.

STANDARD: The fuel system should be clean and there should be no leaks. The system must be properly bled and the engine must start.

STUDENT LEARNING EXPERIENCES:

1. Explain how to remove primary filter, clean container, and install new filter.
2. Discuss how to remove old gasket and install new gasket found in new element.
3. Demonstrate how to reinstall filter element and container on engine.
4. Demonstrate how to bleed system and start engine.
5. Demonstrate how to check filter for leaks and wipe off excess fuel to prevent dust accumulation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the following:
   a. What can be used to determine whether or not the fuel filter has to be changed more frequently?
   b. Why should the fuel lines always be bled after new filter elements are installed? What could happen if they are not?
   c. List the steps used when bleeding fuel lines.
2. Service the diesel fuel filter on the designated tractor with the help of the operator's manual.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, replacement filters and gaskets, clean rags, wrenches, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.18 **TASK:** Replaces injector line.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, Roosa-Master tool set for service nozzles, an injector popper, appropriate fittings, and replacement injector line,

EVALUATION: replace injector line.

STANDARD: All parts must fit correctly. There should be no leaks and the nozzle should operate at pressure specified in the service manual.

STUDENT LEARNING EXPERIENCES:

1. Discuss safety precautions to use when servicing/repairing agricultural power and mahinery fuel systems.
2. Discuss two jobs the injection nozzle must do.
3. Discuss how to test fuel system for plugged or damaged injector line.
4. Demonstrate how to replace injector line.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Consult the appropriate shop manual in servicing diesel fuel injector lines.
2. Replace diesel fuel injector line on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, Roosa-Master tool set, injector nozzle popper, appropriate fittings, replacement injector lien, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.19 **TASK:** Replaces injector washers.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a Roosa-Master tool set for service nozzles, an injector nozzle popper, appropriate fittings, and a service manual,

EVALUATION: service a diesel fuel injector.

STANDARD: All parts must fit correctly. There should be no leaks and the nozzle should operate at pressure specified in the service manual.

STUDENT LEARNING EXPERIENCES:

1. Discuss two jobs the injection nozzle must do.
2. Discuss the three things that you can test the nozzles for.
3. Demonstrate steps involved in servicing a diesel fuel injector.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Consult the appropriate shop manual in servicing a diesel fuel injector.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A service manual, Roosa-Master tool set, an injector nozzle popper, appropriate fittings, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.20 **TASK:** Tests and adjusts injector.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a tractor engine, necessary wrenches, and service manual,

EVALUATION: time the fuel-injector pump on the engine.

STANDARD: The fuel-injector pump must be timed to within one-half degree of the instructor's reading and the specifications given in the service manual.

STUDENT LEARNING EXPERIENCES:

1. Explain how to rotate engine until timing mark on flywheel is correct and timing line on pump gear drive can be seen in timing hole.

2. Discuss how to align pump timing mark and rotate the pump gear counter-clockwise approximately one tooth so that the gears match correctly when pump is installed.

3. Demonstrate how to install pump and how to install retaining cap screws lightly.

4. Discuss how to rotate pump in slotted holes to align timing marks exactly and how to tighten cap screws to recommended torque.

5. Demonstrate how to install lines and controls to pump.

6. Explain how to bleed fuel system.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Practice timing a fuel-injector pump on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A service manual, necessary wrenches, and tractor

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

8.0 **COMPETENCY/SKILL:** Services/repairs the fuel system of tractors and traction units needed for agricultural operations.

8.21 **TASK:** Services/repairs/replaces fuel tank.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the necessary tools,

EVALUATION: remove and clean fuel tank and lines of a small gasoline engine.

STANDARD: After cleaning, fuel must flow freely from the tank to the carburetor. The task must be completed within 10% of the time stated in a flat rate manual.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of handling gasoline.
2. Discuss the fuel requirements of small engines.
3. Identify the causes of fuel stoppage in small engines.
4. Discuss the procedures in troubleshooting fuel systems of various types of small engines.
5. Troubleshoot, remove, and clean a fuel system for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate how to remove and clean fuel tank and lines.
2. Troubleshoot a plugged fuel system.
3. Remove and clean a small engine fuel system.
4. Participate in a discussion of the fuel requirement of small engines.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Necessary tools, and small gasoline engine.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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9.0 **COMPETENCY/SKILL:** Services/repairs lubricating system of tractors and traction units needed for agricultural operations.

9.1 **TASK:** Takes oil sample for analysis.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, and oil analysis kit,

EVALUATION: take oil sample for analysis.

STANDARD: The oil analysis will be taken in accordance with oil analysis instructions.

STUDENT LEARNING EXPERIENCES:

1. Discuss safety precautions to use when servicing/repairing agricultural machinery.
2. Discuss the importance of oil sample analyses to the agricultural machinery manager.
3. Demonstrate how to use an oil sample analysis kit.
4. Take oil sample analysis.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read a sample spectroscopic analysis and discuss the results.
2. Take oil sample analysis on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, oil analysis kit with instructions, and tractor.

RESOURCES:

Jacobs, Clinton O. and William R. Harrell. AGRICULTURAL POWER AND MACHINERY. McGraw-Hill Book Company, New York, NY. 1983.

9.0 **COMPETENCY/SKILL:** Services/repairs lubricating system of tractors and traction units needed for agricultural operations.

9.2 **TASK:** Changes oil.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a wrench for the drain plug, new oil of the type and grade recommended in the operator's manual, clean rags, and a container for the old oil,

EVALUATION: change the tractor oil.

STANDARD: When completed, the dip stick must show the oil is at (but not exceeding) the "full" mark and there must be no leaks.

STUDENT LEARNING EXPERIENCES:

1. Explain why oil changes are important.
2. List 10 steps to be followed when changing the oil in a tractor.
3. Discuss how often tractor oil should be changed.
4. Demonstrate how to follow proceural steps for changing oil.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Change the oil in a tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Wrench for oil drain plug, new oil, clean rags, container for old oil, operator's manual, and tractor.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: PREVENTIVE MAINTENANCE. John Deere and Company, Moline, IL. Chapter 4.

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

9.0 **COMPETENCY/SKILL:** Services/repairs lubricating system of tractors and traction units needed for agricultural operations.

9.3 **TASK:** Changes filter.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the manufacturer's service manual, and necessary tools,

EVALUATION: change the oil filter.

STANDARD: When completed, the oil filter must be the one specified, no oil leaks must exist, and the oil level on the dip stick must show full.

STUDENT LEARNING EXPERIENCES:

Perform the following sequenced job skills:

1. Operate engine until normal operating temperature is reached and stop engine and disconnect coil distributor wire.
2. Locate and clean around drain plug and then remove.
3. Allow crankcase to drain for about 5 minutes.
4. Locate and replace oil filter with same type.
5. Replace drain plug and refill crankcase with new oil of type recommended in the service manual.
6. Connect coil to distributor wire and start engine.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Respond to the following:
   - a. Why is it important to change the oil filter?
   - b. List the functions of an oil filter.
   - c. List three types of oil filter assemblies.
   - d. List steps used in order to replace an oil filter in the designated tractor.
2. Change the oil filter on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, necessary tools and equipment, new filter and oil, and tractor.

RESOURCES:

FUNDAMENTALS OF OPERATIONS: PREVENTIVE MAINTENANCE. John Deere Company. Moline, IL. Pages 60-62. 1984.

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

9.0 COMPETENCY/SKILL: Services/repairs lubricating system of tractors and traction units needed for agricultural operations.

9.4 TASK: Adjusts oil pressure.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, and master oil pressure gauge,

EVALUATION: adjust oil pressure.

STANDARD: The oil pressure must be adjusted to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper safety precautions.
2. Discuss the causes of low oil pressure.
3. Discuss the causes of high oil pressure.
4. Demonstrate how to adjust oil pressure.
5. Before checking the engine oil prsesure, always check the condition of the oil filter. A dirty filter will drop the pressure reading.
6. Check the oil level in the crankcase.
7. Install a master gauge.
8. Start and run the engine at fast-idle speed. When the engine is warmed up to operating temperature, record the pressure reading on the gauge. Compare this reading with the specifications for the engine.
9. Adjust engine oil pressure if necessary.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Adjust oil pressure on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, master oil pressure gauge, and tractor.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: PREVENTIVE MAINTENANCE. John Deere and Company, Moline, IL. 1973.

9.0 **COMPETENCY/SKILL:** Services/repairs lubricating system of tractors and traction units needed for agricultural operations.

9.5 **TASK:** Cleans oil pump inlet screen.

PERFORMANCE OBJECTIVE:

See Task 9.6.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

9.0 **COMPETENCY/SKILL:** Services/repairs lubricating system of tractors and traction units needed for agricultural operations.

9.6 **TASK:** Services/rebuilds and installs oil pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a complete mechanic's tool set, oil gaskets, solvent, and sealers,

EVALUATION: Services/repairs the oil pump.

STANDARD: All parts must be correctly reinstalled and there must be no oil leaks.

STUDENT LEARNING EXPERIENCES:

1. Name two types of oil pumps and point out which one is the most common.
2. Describe the two pumps named above.
3. Discuss the part of an oil pump where most wear will occur.
4. Describe how to measure clearance between pump gears and housing.
5. Demonstrate how to Services/repairs an oil pump.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Consult the appropriate shop manual for the designated tractor in order to find further information in regard to servicing/repairing the oil pump.
2. Service/repair the oil pump on a designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Mechanic's tool set, oil, gaskets, solvents and sealers.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

9.0 **COMPETENCY/SKILL:** Services/repairs lubricating system of tractors and traction units needed for agricultural operations.

9.7 **TASK:** Replaces drive assembly of oil pump.

PERFORMANCE OBJECTIVE:

See Task 9.6.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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9.0 **COMPETENCY/SKILL:** Services/repairs lubricating system of tractors and traction units needed for agricultural operations.

9.8 **TASK:** Cleans oil pan.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a mechanic's tool set and a torque wrench, gasket and gasket compound,

EVALUATION: clean and replace the oil pan and gasket assembly.

STANDARD: The oil pan will be clean, the gasket will be in place and sealed, and the bolts will be tightened to the correct torque. There must be no oil leaks.

STUDENT LEARNING EXPERIENCES:

1. Drain engine oil.
2. Remove oil pan.
3. Clean oil, sludge, dirt, and old gasket from oil pan.
4. Clean all traces of old oil pan gasket from engine block.
5. Coat bottom side of gasket with gasket compound and install on oil pan.
6. Coat top of gasket with gasket compound.
7. Carefully lift pan and gasket into place on engine and run bolts up hand tight. Refer to technical manual for torque specification.
8. Torque bolts in 5 ft. lb. increments until specified torque is reached.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on replacing the oil pan in the manufacturer's service manual. Note the torque of the oil pan bolts.

2. In the shop area, replace the oil pan gasket assembly on the designated tractor. Follow the outlined steps in the Student Learning Tasks.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Mechanic's tool set, torque wrench, new gasket and gasket compound, and tractor

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

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9.0 **COMPETENCY/SKILL:** Services/repairs lubricating system of tractors and traction units needed for agricultural operations.

9.9 **TASK:** Services/replaces oil cooler.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a parts cleaning tank, flare nut wrenches, an air supply and flow gun, and a water tank,

EVALUATION: service the oil cooler.

STANDARD: When service is complete, there will be no visible dirt on the cooler and the cooler will be free of oil leaks.

STUDENT LEARNING EXPERIENCES:

1. Remove oil cooler.
2. Remove dirt from fins.
3. Clean oil tubes with air hose.
4. Check for leaks.
   a. Plug oil outlet.
   b. Install air hose in inlet and turn on air.
   c. Submerge unit in water.
   d. Watch for bubbles. (If no bubbles appear, there is no leakage. If bubbles do appear, locate and repair leaks or replace cooler.)
5. Reinstall oil cooler.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Service the oil cooler on a designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Parts cleaning tank, flare nut wrenches, air supply and flow gun, water tank, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

10.0 **COMPETENCY/SKILL:** Services/repairs the cooling system of tractors and traction units needed for agricultural operations.

10.1 **TASK:** Visually checks coolant level/solution.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a designated tractor and hydrometer,

EVALUATION: test the radiator coolant supply.

STANDARD: The reading must be within one gradation of that of the instructor.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate how to remove radiator cap.
2. Explain how to insert hydrometer and draw enough coolant intio hydrometer to get a reading.
3. Demonstrate how to take reading and make correction for temperature variation.
4. Discuss how to replace coolant in radiator.
5. Discuss how to record hydrometer reading.
6. Demonstrate how to flush hydrometer with clean water.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Test the radiator coolant in a designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Hydrometer and tractor.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: PREVENTIVE MAINTENANCE. John Deere and Company, Moline, IL. Page 79. 1973.

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

10.0 **COMPETENCY/SKILL:** Services/repairs the cooling system of tractors and traction units needed for agricultural operations.

10.2 **TASK:** Installs water pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a socket set, open-end and box-end wrench set, screwdrivers, clamp pliers, gasket sealing compound, and a tractor with a defective water pump,

EVALUATION: replace the water pump.

STANDARD: The replaced water pump must show no signs of leakage and completion of all step in the installation process must be acceptable to the instructor. The fanbelt must be adjusted manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss what will happen if the water pump fails to operate.
2. List three items that basically make a water pump.
3. Cite the possible difficulties encountered in the inspection of a faulty water pump.
4. Demonstrate how to disconnect a hose.
5. Discuss the procedure to follow in replacing a water pump.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Respond to the following:

   a. What will happen if the water pump fails to operate?
   b. Name three items that basically make a water pump.
   c. What are the possible difficulties encountered in the inspection of a faulty water pump?

2. Refer to the correct shop service manual for the designated tractor and list the procedure used to replace the water pump.

3. Replace the water pump on a designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Socket set, open-end and box-end wrench set, screwdrivers, clamp pliers, gasket sealing compound, and tractor.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: PREVENTIVE MAINTENANCE. John Deere and Company, Moline, IL. Page 73. 1973.

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

10.0 **COMPETENCY/SKILL:** Services/repairs the cooling system of tractors and traction units needed for agricultural operations.

10.3 **TASK:** Rebuilds water pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a tractor with a defective water pump, mechanic's tool set, service manual, gasket sealing compound, and needed parts,

EVALUATION: rebuild water pump.

STANDARD: The rebuilt water pump should show no signs of leakage and all steps in the installation process should be acceptable to the instructor. The fanbelt will be adjusted to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper shop safety procedures.
2. Drain cooling system.
3. Remove necessary equipment to reach water pump as specified by type of equipment.
4. Remove water pump from engine.
5. Separate the housing from the pump body.
6. Measure and record the distance from the pump hub to the end of the shaft.
7. Measure and record the distance from the impeller hub to the end of the shaft.
8. Remove the snap-ring from the groove in front of the shaft bearing assembly.
9. Press the shaft and bearing assembly from the housing and from the impeller.
10. Remove the seal from the rear of the housing with the aid of a drift and hammer.
11. Press a new seal into the housing bore.
12. Install new slinger on the bearing shaft.
13. Press the bearing and shaft assembly into thehousing and install the snapring.
14. By using the measurement taken before removal, press the impeller in place on the shaft.

15. Using the measurement taken during the removal, press the pully hub in position on the shaft.

16. Using a new gasket, intall the pump housing to the pump body and secure with the attaching bolts.

17. Clean area where rebuilt pump is to be located.

18. Coat gasket with sealing compound.

19. Install gasket on engine.

20. Install pump on gasket.

21. Reconnect hoses.

22. Replace other equipment and adjust drive belts.

23. Fill with coolant and check for leakage.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Complete the following:

   a. What will happen if the water pump fails to operate?
   b. Name 3 items that basically make up a water pump.
   c. What would you inspect a faulty water pump for?

2. Find the correct SHOP MANUAL for your tractor and list the procedure used to rebuild the water pump.

3. Use the Student Learning Tasks to help you rebuild the water pump on your tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, gasket sealing compound, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

10.0 **COMPETENCY/SKILL:** Services/repairs the cooling system of tractors and traction units needed for agricultural operations.

10.4 **TASK:** Cleans radiator.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a water hose, appropriate tools, and a designated tractor,

EVALUATION: flush and clean the radiator system.

STANDARD: The cleaned cooling system must show no evidence of containing dirty coolant or foreign materials. There must be no spilled coolant on or around the tractor.

STUDENT LEARNING EXPERIENCES:

1. Explain why the engine should be warmed up before the radiator is drained.
2. Discuss why water should be added slowly when refilling the radiator.
3. List seven steps in flushing tractor cooling system.
4. Discuss how to rust-proof a tractor cooling system.
5. Discuss conditions under which a cooling system should be used.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Flush and clean the radiator system on an assigned tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. New coolant, water hose, radiator flushing compound, appropriate tools, and tractor.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: PREVENTIVE MAINTENANCE. John Deere and Company, Moline, IL. 1973.

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

10.0 **COMPETENCY/SKILL:** Services/repairs the cooling system of tractors and traction units needed for agricultural operations.

10.5 **TASK:** Tests radiator cap.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a pressure tester, an adapter, and a tractor,

EVALUATION: test the radiator cap for pressure tolerance.

STANDARD: The gauge reading must be within one gradation of that of the instructor.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate how to install cap on pressure tester.
2. Explain how to pump pressure tester until cap releases.
3. Demonstrate how to record reading on the pressure tester.
4. Compare the reading on the pressure tester with cqp specifications.
5. Explain what a radiator cap does.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Test the radiator cap on a designated tractor for correct pressure tolerance.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Pressure tester, an adapter, and tractor.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: PREVENTIVE MAINTENANCE, John Deere and Company, Moline, IL. Page 83. 1973.

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

10.0 **COMPETENCY/SKILL:** Services/repairs the cooling system of tractors and traction units needed for agricultural operations.

10.6 **TASK:** Repairs radiator.

PERFORMANCE OBJECTIVE:

See Task 10.7.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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10.0 **COMPETENCY/SKILL:** Services/repairs the cooling system of tractors and traction units needed for agricultural operations.

10.7 **TASK:** Replaces radiator.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, and replacement radiator,

EVALUATION: replace radiator on designated tractor.

STANDARD: The cooling system should show no evidence of containing dirty coolant or foreign materials. There should be no leaks in the system. There will be no spilled coolant left on or around the tractor when the job is complete.

STUDENT LEARNING EXPERIENCES:

1. Discuss safety procedures used when servicing/repairing the cooling system.
2. Replace radiator.
3. Connect to attaching bolt.
4. Replace hood.
5. Replace lower attaching bolts.
6. Connect radiator overflow hose from reserve tank.
7. Replace six radiator shroud bolts.
8. Replace radiator hoses and engine fan.

IMPORTANT: Before tightening mounting bolts:

1. Push radiator away from engine and against hydraulic pump support.
2. Force lower radiator hose over radiator pipe as far as possible to provide (13mm) 1/2-in. clearnace with engine pully damper.
3. Caulk all gaps in radiator hood area.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on cooling systems in the manufacturer's service manual.
2. Discuss safety procedures used when servicing/repairing cooling systems.
3. Replace radiator on designated tractor with the help of the Student Learning Tasks and service manual.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A service manual, mechanic's tool set, replacement radiator and hoses, flushing compound, coolant, and tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

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10.0 **COMPETENCY/SKILL:** Services/repairs the cooling system of tractors and traction units needed for agricultural operations.

10.8 **TASK:** Services/repairs fan bearings, belt and pulley.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a new fanbelt, service manual, mechanic's tool set, and belt-tension gauge,

EVALUATION: replace the fanbelt, repair fan bearings and pulley, as necessary, on the designated tractor.

STANDARD: The tension in the new fanbelt will be adjusted to manufacturer's specifications. The fan bearings and pulley will be repaired and operate in accordance with specifications.

STUDENT LEARNING EXPERIENCES:

1. Loosen tension on fanbelt.
2. Remove old belt.
3. Check fan pulley and fan shaft for excess movement. (Repair/replace defective parts to manufacturer's specifications.)
4. Install new fanbelt.
5. Check for correct alignment.
6. Adjust tension to manufacturer's specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Answer the following questions:

   a. What will happen if you tighten a fanbelt too much?
   b. What will happen if the belt is too loose?
   c. Why should the belts be kept clean?
   d. When should you replace a belt?
   e. Describe how to check the tension in the fanbelt.
   f. List and describe 5 steps you would use to adjust the tension in a fanbelt.
   g. Check with instructor before going to next step.

2. Replace the fanbelt on the designated tractor with the help of the Student learning Tasks.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A service manual, a new fanbelt, mechanic's tool set, belt-tension gauge, needed replacement parts, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

10.0 **COMPETENCY/SKILL:** Services/repairs the cooling system of tractors and traction units needed for agricultural operations.

10.9 **TASK:** Replaces thermostat.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, new thermostat and gasket, and the necessary tools,

EVALUATION: replace the cooling system thermostat on an engine.

STANDARD: The new thermostat must be clean, and installed according to directions in the service manual, and installed so as to function properly. There should be no coolant leaks when finished.

STUDENT LEARNING EXPERIENCES:

1. Identify the common types of thermostats found in most engines.
2. Explain the function of a thermostat and the effects of a thermostat that is not functioning properly.
3. Discuss what is involved in a thermostat inspection.
4. Explain how to decide if the thermostat is being installed right side up.
5. Demonstrate steps in replacing a thermostat.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

2. Describe steps in replacing a thermostat.

2. Practice replacing the thermostat on the engine.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A service manual, new thermostat and gasket, necessary tools, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

10.0 **COMPETENCY/SKILL:** Services/repairs the cooling system of tractors and traction units needed for agricultural operations.

10.10 **TASK:** Replaces hoses.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a screwdriver, hose-clamp pliers, and scraper,

EVALUATION: replace the radiator hose on designated tractor.

STANDARD: The new hose should show no visible signs of leaks.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate how to drain cooling system.
2. Discuss how to remove old hose.
3. Explain how to clean radiator neck and engine inlet/outlet fixtures.
4. Demonstrate how to install new radiator hose.
5. Explain how to refill with coolant and check for leaks.
6. Demonstrate how to tighten any loose connections.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Respond to the following:
   a. How often should cooling system hoses be replaced?
   b. Radiator hoses can be damaged by ______, ________, and ______.
   c. What will happen to a hose that is improperly installed?
2. Replace the radiator on a assigned tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A screwdriver, hose-clamp pliers, scraper, coolant, new hoses, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

11.0 COMPETENCY/SKILL: Services/repairs brake system of tractors and traction units needed for agricultural operations.

11.1 TASK: Adjusts brakes.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given rebuilt brake shoes, a service manual, jack, wheel blocks, solvents and rags, replacement parts, a mechanic's tool set and a brake tool set,

EVALUATION: repair and adjust a brake assembly.

STANDARD: Demonstrate safety procedures. All parts will be clean, back in place and the brakes will be adjusted to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

NOTE: Bleed the brake system whenever air is allowed to enter the system, such as replacing components.

1. Discuss safety procedures used when servicing/repairing equipment brake systems.
2. Attach transparent hose to bleed screw.
3. Disengage coupler bar on brake pedals.
4. Start engine and run at fast idle

   CAUTION: Place transmission in park and speed range lever in neutral. Leave engine running throughout bleeding process.

5. Unscrew bleed screw with hose attached 3/4 turn.
6. Depress pedal of brake being bled. Allow pedal to return slowly. Continue pumping until transparent hose is free of air bubbles.
7. Hold brake pedal down and tighten bleed screw securely.
8. Move transparent hose to other bleed screw and repeat process.
9. Discard drained fluid and replenish oil in hydraulic reservoir.
10. Check brake pedals for solid feel when applied. Repeat process as necessary, or service brake components as needed.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on brake repair in the manufacturer's service manual.

2. Discuss safety procedures used when servicing/repairing equipment brake systems.

3. With the help of the Student Learning Tasks and service manual, adjust brakes.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Rebuilt brake shoes, service manual, jack wheel blocks, solvents and rags, replacement parts, mechanic's tool set, brake tool set, and tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

11.0 **COMPETENCY/SKILL:** Services/repairs brake system of tractors and traction units needed for agricultural operations.

11.1.1 **TASK:** Adjusts brakes. (Pre-charge brake accumulator.)

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, instruction in shop safety, necessary equipment and supplies, and tractor,

EVALUATION: adjust brakes.

STANDARD: Demonstrate safety practice. All parts and connections will be clean, back in place, the accumulator will be pre-charged and the brakes will be adjusted to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

IMPORTANT: Use dry nitrogen only to pre-charge accumulator. Dry nitrogen does not mix with oil. It is noncombustible, will not cause oxidation or condensation within accumulator, and is not harmful to piston seal. Do not use air or any combustible gas as they may cause oxidation or condensation harmful to oil, piston, seal or accumulator.

CAUTION: Do not stand in line with accumulator ends. Slowly open cylinder and regulator valves, wear protective eye goggles.

1. Discuss the safety aspects of adjusting, or pre-charging brake accumulator.
2. Open nitrogen cylinder valve for an instant to purge system of contamination and air.
3. Remove Tru-Seal nut from adapter assembly.
4. Install two O-Rings on adapter assembly and install Tru-Seal nut. (Teflon side towards accumulator.)
5. Install adapter assembly in gas check valve part of accumulator.
6. Attach regulator to cylinder valve and tighten securely.
7. Attach high pressure hose to regulator outlet and turn pressure regulator screw counterclockwise until it turns freely.
8. Turn depressing screw of gas cock counterclockwise. Install gas cock on adapter assembly and secure hose to nitrogen regulator.

9. Check all connections.

10. Rotate gas cock screw clockwise to open accumulator gas check valve.

11. Slowly open cylinder shut off valve until gauge needle stops moving then fully open valve.

12. Turn pressure regulator screw clockwise to get 3280 to 3620 kpa (475 to 525 psi).

13. Close cylinder valve and turn regulator valve counterclockwise.

14. Close gas cock (rotate counterclockwise).

15. Remove high pressure hose and tee from accumulator.

    NOTE: If accumulator is over charged, remove the hose from the gas cock and fitting. Using the gas cock, depress the charging valve in the accumulator allowing excess gas to escape. Reinstall gauge and check pressure.

16. Install charging valve plug.

17. Install accumulator, test accumulator and bleed the brakes.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on brakes repair in the manufacturer's service manual.

2. Discuss the safety procedures when working with materials and equipment pressure systems.

3. With the help of the Student Learning Tasks and service manual, adjust and pre-charge brake accumulator.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, necessary equipment and supplies, and tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

11.0 **COMPETENCY/SKILL:** Services/repairs brake system of tractors and traction units needed for agricultural operations.

11.2 **TASK:** Replaces brake pads, discs and pistons.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given rebuilt brake shoes, a service manual, jack, wheel blocks, solvents and rags, replacement parts, a mechanic's tool set,

EVALUATION: repair brake assembly.

STANDARD: All parts must be clean and back in place. The brakes must be adjusted to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. There are several types of brake assemblies. Check manufacturer's service manual for specific details.
2. Discuss safety aspects of servicing tractor brakes.
3. List steps to jack up tractor and remove wheel.
4. Discuss procedures of various manufacturers to repair brake assemblies.
5. Repair brake assemblies.
6. Clean all parts and adjust brake assemblies as specified for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Respond to the following:

   a. List and describe three methods that provide braking action.
   b. What are two things that can indicate when brakes need adjustment or repair?
   c. Describe the steps that you would use when adjusting the brakes after you have replaced worn parts.

2. Check the opertor's manual or FARM TRACTOR TUNE-UP AND SERVICE SPECIFICATIONS for the amount the brakes should be tightened for tractor under repair.

3. Repair the brake assembly on the assigned tractor with the help of the service manual.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Rebuilt brake shoes, service manual, jack, wheel blocks, solvents and rags, replacement parts, mechanic's tool set, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983

11.0 **COMPETENCY/SKILL:** Services/repairs brake system of tractors and traction units needed for agricultural operations.

11.3 **TASK:** Relines brakes.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, solvents and rags, replacement parts, a mechanic's tool set, and brake tool set,

EVALUATION: reline brakes.

STANDARD: All parts will be clean, back in place and the brakes will be adjusted to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

IMPORTANT: Clean all housings and connections in the brake system before disconnecting lines. Cap or plug lines and openings to keep dirt out.

CAUTION: Before servicing components, stop the engine and bleed the brakes at the differential bleed screws until pressure is relieved.

1. Demonstrate safety procedures used when servicing/repairing brake assembly.
2. Install new facings on pressure plates and backing plate.
3. The new facing must be 3mm (o.1 in.) thick.
4. The rivet head must be 1.6mm (0.06 in.) below the service of the facing.
5. Press piston into pressure plate until piston bottoms.
6. Install new oil soaked paper washer and O-ring in each piston bore.

   NOTE: Paper washer must be on the outer side of the groove.

7. Install piston and pressure plate assembly.
8. Install sun pinion and brake disk.
9. Install backing plate with facing towards disk and axle housing.
10. Install drive unit and bleed the brakes.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on brake repair in the manufacturer's service manual.
2. Discuss safety procedures used when servicing/repairing brake assembly.
3. Reline brakes on assigned tractor with the help of the Student Learning Tasks and service manual.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, solvents and rags, replacement parts, mechanic's tool set, brake tool set, and tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

11.0 **COMPETENCY/SKILL:** Services/repairs brake system of tractors and traction units needed for agricultural operations.

11.4 **TASK:** Replaces brake linings.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, solvents and rags, replacement parts, a mechanic's tool set and brake tool set,

EVALUATION: replace brake linings.

STANDARD: All parts will be clean, back in place and the brakes will be adjusted to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

IMPORTANT: Clean all housings and connections in the brake system before disconnecting lines. Cap or plug lines and openings to keep dirt out.

CAUTION: Before servicing components, stop the engine and bleed the brakes at the differential bleed screws until pressure is relieved.

1. Demonstrate safety procedures used when servicing/repairing brake assembly.

2. Remove drive unit and axle housings.

3. Remove backing plate, disk, and pinion.

4. Remove pressure plates, and pull pistons from cylinders.

5. Inspect backing plate for missing rivets or worn or loose facings. New facings are 3mm (1/8-in.) thick, rivet heads are 1.6mm (1/16-in.) below facings before rivets contact brake disk. If facings are being replaced, drill slightly larger than shaft of rivet.

6. Inspect brake disk. It must be flat within 0.1mm per 25.4mm (0.004-in.) of disk O.D.

7. Inspect brake disk for excessive wear in sun pinon mounting area.

8. Remove piston and pressure plate assemblies.

9. Remove O-ring and paper washer from piston bore.

   NOTE: Soak new paper washer in John Deere HY_GARD Transmission and Hydraulic Oil or an equivalent for installation.

10. Inspect piston bore and clean if necessary. Bore must not be pitted or scored.

11. Inspect pressure plates for missing rivets, worn or loose facings.

12. To remove pressure plate facings, drill out each rivet head with a drill slightly larger than the shaft of the rivet.

13. Inspect brake pistons for pitting or scoring.

14. If pressure plate facing is being replaced, press piston out of pressure plate so rivets can be removed.

    NOTE: If piston and not the pressure plate facing is being replaced, use a knife edge puller to remove the piston.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on brake assemblies in the manufacturer's service manual.
2. Discuss safety procedures used when servicing/repairing brake assembly.
3. Replace brake linings on designated tractor with the help of the Student Learning Tasks and service manual.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, solvents and rags, replacement parts, mechanic's tool set, brake tool set, jack, wheel blocks, and tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

11.0 **COMPETENCY/SKILL:** Services/repairs brake system of tractors and traction units needed for agricultural operations.

11.5 **TASK:** Replaces springs.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, solvents and rags, replacement parts, a mechanic's tool set and brake tool set,

EVALUATION: replace springs.

STANDARD: All parts will be clean, back in place and the brakes will be adjusted to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate safety procedures used when servicing/repairing brake assembly.
2. Disconnect brake tubes.
3. Disconnect pressure and return lines.
4. Remove brake arm pins (2 used) and pivot shaft.
5. Remove attaching bolts, and remove valve.
6. Remove three cap screws, hydraulic fittings, and retainer from pedal bracket.
7. Remove pedal bracket with operating rods from valve housing.
8. Remove operating rod assembly.
9. Remove guides and O-rings.
10. Remove equalizing valve pins and operating rod guides and bracket.
11. Remove equalizing valve, ball, and spring.
12. Remove manual brake piston and plunger. Remove plunger to remove O-ring and paper washer from inside manual brake piston.
13. Remove spring.
14. Use a deep well socket to remove brake valve with nipple assembly. Remove O-ring.
15. Remove back-up ring and O-ring from brake valve housing.
16. Pull equalizer valve guide with shaft out of housing. Remove spring and ball.

17. Lift sleeve off equalizer valve guide and remove O-ring.

18. Pull equalizer valve shaft out of valve guide.

19. Remove washer and O-ring.

20. Inspect equalizing valve spring.

21. Remove plug to remove spring, and check valve disk.

22. Remove O-ring from plug.

23. Remove plug to remove spring and steel ball.

24. Remove O-ring, screen, and O-ring from plug.

25. Inspect parts and brake valve housing bore of contaminations. Clean as necessary.

26. Remove oil inlet connector to remove steel ball, guide, spring, and washer.

27. Remove O-ring from connector.

28. Inspect pressure line and check ball spring.

29. Replace parts as necessary.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on brake assemblies in the manufacturer's service manual.

2. Discuss safety procedures used when servicing/repairing brake assembly.

3. Replace springs on assigned tractor with the help of the Student Learning Tasks and service manual.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, solvents and rags, replacement parts, mechanic's tool set, brake tool set, jack, wheel blocks, and tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

11.0 **COMPETENCY/SKILL:** Services/repairs brake system of tractors and traction units needed for agricultural operations.

11.6 **TASK:** Rebuilds complete brake system.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given rebuilt brake shoes, a service manual, jack, wheel blocks, solvents and rags, replacement parts, a mechanic's tool set and braketool set,

EVALUATION: rebuild complete brake system.

STANDARD: All parts will be clean, back in place and the brakes will be adjusted to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

NOTE: There are several types of brake assemblies. Check manufacturer's service manual for specific details.

1. Demonstrate safety procedures used when servicing/repairing brake assembly.
2. Block wheels.
3. Jack up tractor and remove wheel.
4. Pull off brake drum.
5. Remove shoe retainers.
6. Remove shoes.
7. Clean all parts and inspect for excessive wear.
8. Replace shoes with rebuilt shoes.
9. Replace all worn parts as necessary.
10. Reinstall shoes and hardware including return springs, adjusting mechanism and shoe retainers.
11. Reinstall drum. (Have drum turned if deeply grooved.)
12. Reinstall wheel.
13. Adjust brake shoes to manufacturer's specifications.
14. Repeat procedure for other wheel.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Complete the following questions:

   A. List and describe three methods that provide braking action.
   B. What are two things that can indicate when brakes need adjustment or repair?
   C. Describe the steps that you would use when adjusting the brakes after you have replaced the worn parts.

2. Check the operator's manual of FARM TRACTOR TUNE-UP AND SERVICE SPECIFICATION for the amount the brakes should be tightened for your tractor.

3. Repair the brake assembly on an assigned tractor with the help of the Student Learning Tasks and service manual.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Rebuilt brake shoes, service manual, solvents and rags, replacement parts, mechanic's tool set, brake tool set, jack, wheel blocks, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

12.0 **COMPETENCY/SKILL:** Overhauls the engine of tractors and traction units needed for agricultural operations.

12.1 **TASK:** Replaces piston.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a mechanic's tool set and piston ring compressor,

EVALUATION: install a piston in the designated tractor.

STANDARD: The piston will be installed without any damage to any part of the engine.

STUDENT LEARNING EXPERIENCES:

1. With rings installed on piston and lightly oiled, rod installed in piston, and cylinder honed and cleaned, tighten ring compresser on piston and rings.
2. Place piston in cylinder being sure the correct side faces front and the rod correctly fits on the crankshaft.
3. Tap piston down into cylinder with a block of soft wood or soft-faced hammer, watching to see that the rod seats correctly on the crankshaft.
4. Install bearing inserts and rod caps.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section servicing the piston assembly in manufacturer's service manual for instructions on how to position the piston in the cylinder.
2. Complete the following questions:
    A. Why must you throughly lubricate each piston and its ring with engine oil just prior to installation on the cylinder?

    B. Why should you never pound on the piston head?
3. Install a piston assembly in the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, piston ring compressor, replacement parts, necessary tools and equipment, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

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12.0 **COMPETENCY/SKILL:** Overhauls the engine of tractors and traction units needed for agricultural operations.

12.2 **TASK:** Replaces cylinder sleeves (dry).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a mechanic's tool set, service manual, and a sleeve puller,

EVALUATION: replace dry cylinder sleeves.

STANDARD: The old cylinder sleeves will be removed without damage to the block; the block will be thoroughly cleaned and the new sleeves will be fully seated.

STUDENT LEARNING EXPERIENCES:

1. Remove grease or from new sleeve. "Mic" to insure proper size.
2. Put new sleeves in freezer. (This shrinks them for easier installation.)
3. With cylinder head and pistons removed, put sleeve puller in place over one cylinder.
4. Make sure puller bears only on the sleeve and does not contact cylinder block.
5. Turn puller only with hand tool and remove old sleeve.
6. Remove other sleeve the same way.
7. Clean out cylinder holes in block.
8. Remove new sleeves from freezer and insert them quickly. If they do not seat freely, they must be tapped into place quickly with a soft-faced hammer before they warm up and swell.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on cylinders in the manufacturer's service manual.

2. Answer the following questions after reading the above assignments:

   A. Before installing dry-type cylinder sleeve why must you ALWAYS inspect the cylinder bores?

   B. If the bores are distorted what should you do?

   C. Describe how you would clean carbon and gum deposits from the cylinder bores.

   D. List the recommendations the manufacturer gives for installing new sleeves.

3. In the shop area, replace the dry sleeves on the designated tractor engine.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, sleeve puller, replacement parts, necessary tools and equipment, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

12.0 **COMPETENCY/SKILL:** Overhauls the engine of tractors and traction units needed for agricultural operations.

12.2.1 **TASK:** Replaces cylinder sleeves (wet).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given new sleeves, service manual, lubricants, seals, the necessary tools and checking equipment,

EVALUATION: replace wet cylinder sleeves on the designated engine.

STANDARD: Disassembly and reassembly will follow manufacturer's instructions. The out-of-roundness will be within manufacturer's specifications, the cylinder will not leak, and there will be no damage to any parts.

STUDENT LEARNING EXPERIENCES:

NOTE: In the individually cast cylinder the casting may be called a "liner" or a "sleeve". They may be dry liners, or wet liners.

1. Read manufacturer's service manual for instructions for removing all parts necessary to reach the cylinder sleeve. Details of removal will vary with size and type of engine.

2. Use screw-threaded or impact pullers to remove sleeve. (In stubborn cases other aids must be used. It may be necessary to use inhibited acid compounds to remove scales from the water jacket and free the sleeve. Penetrating oil, solvents, or heat may help.)

3. With sleeve removed, clean the lower sealing ring surface in the block to prevent coolant leakage past the sealing rings.

4. Measure the cylinder bore for taper and out-of-roundness. Rebore and hone if necessary. Clean thoroughly.

5. Clean all deposits from under the flange of sleeve and mating bore in block. (Sleeve must rest flat to prevent distortion.)

6. Check sleeve bore in block. If flange surface is uneven, re-machine it.

7. Clean the lower sealing surface in block and sleeve to prevent coolant leaks when sleeve is installed.

8. Install new sleeve without seals and check height at several places to be certain sleeve is seated squarely. Compare the height to engine specifications and machine the block or add shims if necessary.

9. Remove sleeve and put new seals on sleeve. Lubricate the seal and the mating surfaces in the block with material recommended by manufacturer.

10. Work sleeve into place (by hand) as far as possible. Finish seating the sleeve by placing a wood block over it and hammer gently.

11. Check for correct liner installation by measuring the out-of-roundness in the liner bore. If distorted, check for twisted seals or deposits on the liner seats.

12. Following instructions in the service manual, reassemble all parts.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Answer the following questions:

   A. What is the difference between a wet cylinder sleeve and a dry cylinder sleeve?

   B. When installing new wet liners in sleeves why must they lie flat?

   C. Describe a good method used to prevent coolant leaks when a new liner is installed.

   D. Explain how to check for correct liner installation.

2. Replace the wet sleeves of the assigned engine.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, new sleeves, lubricants, seals, mechanic's tool set, necessary tools and checking equipment, replacement parts, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

12.0 **COMPETENCY/SKILL:** Overhauls the engine of tractors and traction units needed for agricultural operations.

12.3 **TASK:** Replaces connecting rods.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a mechanic's tool set, service manual, micrometers, plastigage, and a soft-face hammer,

EVALUATION: install connecting rod and caps on designated tractor.

STANDARD: The bearings will be properly seated as specified in the service manual.

STUDENT LEARNING EXPERIENCES:

1. Remove all parts necessary to make piston and crankshaft accessible. Mark parts for proper assembly.
2. Unbolt rod cap.
3. Jar cap loose from rod with a soft-faced hammer.
4. Remove cap, noting its position for reassembly.
5. Push rod away from crankshaft, taking care not to scratch crankshaft journal.
6. Use a micrometer to check the crankshaft journal for excess wear (if piston is to be removed for ring replacement, etc., now is the time).
7. Pry insert from rod and rod cap.
8. Install new inserts in the same piston.
9. Oil bearings lightly with engine oil.
10. Reseat rod on crankshaft journal. Do not scratch crankshaft.
11. Reinstall rod cap.
12. Torque to specifications (to set inserts).
13. Remove cap and place a strip of "plastigage" across the insert.
14. Replace cap and torque to specifictions.
15. Remove cap and measure plastigage width using card that comes with plastigage.

16. If clearance is within specified limits, clean plastigage from insert and journal. Lubricate, install, and torque rod cap.

17. Bend up lock tabs or install lock wires as required.

18. Reassemble engine.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study carefully the section on connecting rods and caps in the manufacturer's service manual.

2. Install connecting rod caps on the designated tractor. Follow the steps outlined in the Student Learning Tasks.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, micrometer, plastigage, soft-face hammer, needed parts and equipment, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

12.0 COMPETENCY/SKILL: Overhauls the engine of tractors and traction units needed for agricultural operations.

12.4 TASK: Rebushes connecting rods.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a complete mechanic's tool set, service manual, micrometers, plastigage, and a soft-faced hammer,

EVALUATION: install rod bearing on the designated tractor.

STANDARD: Installed rod bearings will be properly seated. All bearings will be torqued and clearance checked as specified in the service manual.

STUDENT LEARNING EXPERIENCES:

1. Remove all parts necessary to make piston and crankshaft accessible.
2. Unbolt rod cap.
3. Jar cap loose from rod with a soft-faced hammer.
4. Remove cap noting its position for reassembly. Mark them if not marked.
5. Push rod from crankshaft taking care not to scratch journal.
6. "Mic" Journal for excess wear. (If piston is to be removed for ring replacement, etc., now is the time.)
7. Pry insert from rod and rod cap.
8. Remove rod bearings and install new rod bearings.
9. Install new inserts in the same position.
10. Oil bearings lightly with engine oil.
11. Reseat rod on crankshaft journal. Do not scratch crankshaft.
12. Reinstall rod cap.
13. Torque to specifications (to seat inserts.)
14. Remove cap and place a strip of "plastigage" across the insert.
15. Replace cap and torque to specifications.
16. Remove cap and measure plastigage width using card that comes with plastigage.

17. If clearance is within specified limits, clean plastigage from insert and journal. Lubricate, install, and torque rod cap.

18. Bend up lock tabs or reinstall lock wires as required.

19. Reassemble engine.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the service manual for instructions in removing all parts necessary to make the pistons and crankshaft accessible.

2. Make a note of the torque specifications needed for this task.

3. Install the rod bearings on the designated tractor engine. Follow the steps outlined in the Student Learning Tasks.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, micrometer, plastigage, soft-face hammer, needed parts and equipment, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

12.0 **COMPETENCY/SKILL:** Overhauls the engine of tractors and traction units needed for agricultural operations.

12.5 **TASK:** Replaces bolts.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, and mechanic's tool set,

EVALUATION: replace cylinder head bolts on designated tractor.

STANDARD: The replaced cylinder head bolts must be sized and torqued according to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper shop safety procedures.
2. Remove all necessary sheet metal parts and fittings.
3. Clean dirt and trash from valve cover.
4. Remove cap screw or nuts securing valve cover.
5. Tap cover with mallet to break seal.
6. Remove and clean inside of valve cover.
7. Inspect cylinder head bolts, if damaged or worn, remove and replace.
8. Torque to manufacturer's specifications.
9. Adjust cylinder valves if necessary.
10. Reassemble according to service manual.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Check or other engine technical manual for replacing cylinder head bolts.
2. Following a demonstration, have students replace cylinder head bolts using service manual.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and tractor.

RESOURCES:

Jacobs, Clinton O., Mervin Stearns, Keith E. Mattox. FARM TRACTOR MAINTENANCE: A UNIT OF INSTRUCTION OF FARM TRACTOR MAINTENANCE FOR VOCATIONAL AGRICULTURE. Department of Agricultural Education, University of Arizona, Tucson, AZ. 1975.

12.0 **COMPETENCY/SKILL:** Overhauls the engine of tractors and traction units needed for agricultural operations.

12.6 **TASK:** Checks head for cracks/warpage.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a cylinder head and block, a straight-edge, and a feeler gauge,

EVALUATION: check cylinder head and block for warpage and mark all excessive warpage.

STANDARD: All excessive warpage will be marked. The marked warpage of the cylinder head will include all warped portions that exceed .001" per one inch, .003" per six inches, or .008" for the complete length of the head.

STUDENT LEARNING EXPERIENCES:

1. Remove and clean the head.
2. Lay a straight-edge across the head.
3. Check with feeler gauge under straight-edge for clearance. (Generally the clearance must not exceed .001" per one inch, .003" per six inches, or .008" for the complete length of the head.)
4. Check mating surface of the block in the same way.
5. Mark all excessive warpage.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Answer the following questions:
   - A. Describe how you would remove the cylinder head for the assigned tractor.
   - B. What causes the cylinder head to warp?
2. Check engine technical manual for refacing limits.
3. Check the cylinder head and engine block on a designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, straight-edge and feeler gauge, and a cylinder head and block.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

12.0 **COMPETENCY/SKILL:** Overhauls the engine of tractors and traction units needed for agricultural operations.

12.7 **TASK:** Replaces gaskets.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment, sealants,

EVALUATION: replace gaskets on designated tractor engine.

STANDARD: Gaskets must be installed with no leaks and all connecting bolts will be torqued according to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper shop safety procedures.
2. Replace combination manifold gasket (inline engines).
3. Clean all gasket surfaces.
4. Check for cracks.
5. Check heat riser and alignment. Lay straight-edge on manifold to head surface to check. If misaligned, loosen center bolts where intake and exhaust manifolds join. Do not tighten until assembly is bolted to head, then retighten.
6. Install finger tight.
7. Check that pilot, or locating rings and gaskets are in place.
8. Torque to specifications in proper sequence.
9. Replace cylinder head gasket.
10. Clean gasket surfaces, do not reuse gaskets. Engines using a steel (shim) gasket, coat both sides with a good sealer, bead side up.
11. Install cylinder head according to service manual specifications.

    NOTE: Engines using composition (steel asbestos) gaskets must have heads retorqued after warm-up, [retightening heads effects valve lash.]

12. Check valve cover gasket for damage, replace if necessary.

13. Replace valve cover and tighten screws. Do not overtighten, cover can be easily distorted which will result in oil leakage.

14. Reassemble sheet metal units.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Install/replace gaskets on the designated tractor engine.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, sealants, and tractor engine.

RESOURCES:

Jacobs, Clinton O., Mervin Stearns, Keith E. Mattox. FARM TRACTOR MAINTENANCE: A UNIT OF INSTRUCTION OF FARM TRACTOR MAINTENANCE FOR VOCATIONAL AGRICULTURE. Department of Agricultural Education, University of Arizona, Tucson, AZ. 1975.

12.0 **COMPETENCY/SKILL:** Overhauls the engine of tractors and traction units needed for agricultural operations.

12.8 **TASK:** Replaces camshaft.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a complete mechanic's tool set, service manual and a micrometer,

EVALUATION: measure the camshaft for wear.

STANDARD: All variations from the specifications will be determined.

STUDENT LEARNING EXPERIENCES:

1. Remove camshaft and inspect visually for obvious damage.
2. Using appropriate micrometer, measure each lobe of the cam and record measurement.
3. Compare your measurement with specifications for the camshaft.
4. Reinstall or replace camshaft as necessary.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Answer the following questions:
    A. When should you always check the camshaft?
    B. What is the function of a camshaft in the engine?
    C. What should you look for when inspecting the camshaft journals?
2. Measure the camshaft wear on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, micrometer, necessary tools and equipment, and tractor engine.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

12.0 **COMPETENCY/SKILL:** Overhauls the engine of tractors and traction units needed for agricultural operations.

12.9 **TASK:** Replaces crankshaft.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a mechanic's tool set, service manual, and plastigage,

EVALUATION: replace a crankshaft on the designated tractor.

STANDARD: The following steps will be completed:

1. Installed main bearing inserts.
2. Installed main cap inserts.
3. Torqued and installed main caps.
4. Identified clearance using plastigage.
5. Installed pistons and rods.

STUDENT LEARNING EXPERIENCES:

1. Remove old crankshaft. Mark parts for proper reassembly.
2. New bearings should be used on a new crankshaft. Replace both main and rod bearings.
3. Install inserts in block for main bearings.
4. Install inserts in main caps.
5. Lubricate inserts with engine oil.
6. Put crank in place and install main caps, being sure caps are on the correct bearings and turned the right way.
7. Torque all main cap bolts.
8. Remove front main cap and place a strip of plastigage across the full width of the insert.
9. Install and torque cap.
10. Remove cap and measure plastigage (at front, center, and back of insert).
11. If clearance is not to specifications, correct it with over- or under-sized insert and check again.
12. When clearance is correct, clean plastigage off insert and journal, and replace and torque cap.
13. Do the same for each additional main bearing.
14. Turn crankshaft a few turns by hand to be sure it does not bind.

15. Install number one piston and rod.

16. Install inserts and rod cap and check clearance as shown previously.

17. Turn crankshaft by hand to check for binding.

18. Follow the safe procedure for each additional piston and rod.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on crankshafts in or the manufacturer's service manual. Make a note of the torque specifications.

2. Answer the following questions:

   A. What is a crankshaft?

   B. What are the three main parts of the crankshaft?

   C. Name six things for which you should check when a crankshaft has been removed for reconditioning.

   D. If one of the main journals is defective should the whole crankshaft be replaced? Why?

   E. Should the crankshaft have any end play? Why?

   F. What will happen if the crankshaft has too much end play? Too little end play?

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, plastigage, needed parts and equipment, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

12.0 **COMPETENCY/SKILL:** Overhauls the engine of tractors and traction units needed for agricultural operations.

12.10 **TASK:** Grinds valves.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a mechanic's tool set, service manual, a valve spring compressor, and valve grinding machine,

EVALUATION: grind the valves.

STANDARD: The valves will be ground so they will mate perfectly with their seats. There will be no traces of lapping compound on or around the valves.

STUDENT LEARNING EXPERIENCES:

1. Remove cylinder head.
2. Remove valve springs and keepers, being careful to keep all parts in order so they can be reassembled.
3. Remove valves, keeping them in order.
4. Check valve stems and guide for wear. Replace if necessary.
5. Grind each valve to specified face angle. Check for adequate margin.
6. Using lapping compound and hand-lapping tool, mate each valve to its seat. Then REMOVE ALL TRACES OF LAPPING COMPOUND.
7. Reinstall valve springs and keepers in their original place.
8. Reinstall head and adjust valves.

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SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study the section on valves and seat in a SHOP MANUAL for the designated tractor.

2. Answer the following questions:

   A. What is the purpose of valve seating?

   B. Why is valve grinding necessary?

3. Grind the valves that were removed from the designated engine.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, valve spring compressor, valve grinding machine, lapping compound, needed parts and equipment, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

12.0 **COMPETENCY/SKILL:** Overhauls the engine of tractors and traction units needed for agricultural operations.

12.11 **TASK:** Replaces valve seats.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a mechanic's tool set, a valve grinding machine, lapping compound, service manual, and a tool and valve-seat refacing set,

EVALUATION: reface/replace the valve seats.

STANDARD: The valve seats will mate perfectly with the valves and all lapping compound will be removed upon completion.

STUDENT LEARNING EXPERIENCES:

1. Remove cylinder head.
2. Remove valve springs and keepers using a valve spring compressor. Keep them in order for reinstallation.
3. Check valves, stem, and guides for wear. Replace as necessary.
4. Remove valves, keeping them in order.
5. Grind valves to specified face angle as necessary.
6. Select proper pilot to fit valve guide.
7. Dress refacing stone to specified angle.
8. Reface valve seats, redressing stone as necessary. Take off only enough to get a smooth seat.
9. Narrow seats if neessary, using proper stone to cut off upper surface of face.
10. Using lapping compound and a hand-lapping tool, mate each valve to its seat. Remove all traces of lapping compound.
11. Reinstall valves, springs, and keepers in their original places.
12. Reinstall head and adjust valves.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study the section on valve assembly in the manufacturer's service manual.

2. Answer the following questions:

   A. Describe a good method to prevent cutting valve seats to wide.

   B. Wide seats improve _________, while narrow seats give better _________ of valve.

   C. What should be done to the valve seat to cause a better seating force? What are the good and bad points that will result from this?

   D. When grinding valve seats, how much of the valve face should be exposed to the combustion chamber?

   E. List five precautions for grinding valve seats.

   F. What are three things that will assure a good valve seat?

   G. What are the manufacturer's specifications for the valve seat runout (eccentricity)?

3. Replace the valve seats on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, valve spring compressor, valve grinding machine, lapping compound, a tool and valve-seat refacing set, needed parts and equipment, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

12.0 **COMPETENCY/SKILL:** Overhauls the engine of tractors and traction units needed for agricultural operations.

12.12 **TASK:** Replaces rocker arms.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given new rocker arms, a mechanic's tool set, service manual, outside micrometers and telescoping gauges,

EVALUATION: replace the rocker arms on the designated tractor.

STANDARD: The valves will be adjusted to specifications. All following steps will have been completed and be acceptable to the instructor:

1. Removed valve cover.
2. Removed rocker arm assembly.
3. Inspected parts.
4. Installed new parts.
5. Adjusted valves.
6. Replaced valve cover.

STUDENT LEARNING EXPERIENCES:

1. Remove valve cover.

2. Remove rocker arm assembly.

3. Remove lock pin and slide rocker shaft out of rocker assembly, keeping other parts in order.

4. Inspect parts for wear. Use micrometer.

5. Reassemble on an old shaft if it is usable, or on a new shaft if necessary. Use the old parts that are usable and replace those that show excessive wear.

6. Replace assembly and adjust valves.

7. Replace valve cover.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study the section on replacing rocker arms in the manufacturer's service manual or the I & T SHOP MANUAL.

2. Complete the following questions:

   A. What is a rocker arm and what is its function?

   B. What should you look for when inspecting the following rocker arm components?

      (1) rocker arm shaft
      (2) rocker arms
      (3) space springs

   C. When should you replace or recondition rocker arms?

   D. Why is it important to clean the holes in the rocker arm mounting brackets?

   E. When installing rocker arms why must you always install the arms and springs in the same sequence?

3. Watch another student as he or she replaces the rocker arms.

4. Replace the rocker arms on the designated tractor. Follow the steps outlined in the Student Tasks.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, new rocker arms, outside micrometers, telescoping gauges, necessry parts and equipment, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

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12.0 **COMPETENCY/SKILL:** Overhauls the engine of tractors and traction units needed for agricultural operations.

12.13 **TASK:** Installs pushrod.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, fine wire, needed parts and equipment,

EVALUATION: remove and replace pushrod on the designated tractor.

STANDARD: All pushrods needing service must be detected, damaged pushrods must be removed and replaced. New pushrods must be installed to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper shop safety procedures.
2. Remove and inspect the pushrods. If hollow, clean out the oil passages using fine wire.
3. Roll each pushrod over a piece of clean glass or plastic. If a distinct clicking sound is heard as the pushrod rolls, the rod is bent.
4. Replace damaged pushrod.
5. Measure the length of the pushrods, the length of all pushrods must be equal.
6. Reinstall pushrods to specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss procedures for removal and installation of pushrods.
2. Following a demonstration, have students replace pushrods on designated tractor. using the appropriate shop manual or the manufacturer' service manual.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, fine wire, needed parts and equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983

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12.14 **TASK:** Installs short block.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a standard set of tools used by small engine mechanics,

EVALUATION: install a short block.

STANDARD: The short block must be installed in such a manner that all external components function. The engine should operate at the specified RPM and should deliver the horsepower prescribed by the manufacturer, as measured by a dynamometer.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of installing a short block.
2. Identify the causes of the need to install a short block.
3. Discuss the procedures as outlined in service manuals for installing a short block.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate how to install a short block.
2. Remove and inspect a short block.
3. Install a short block.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, small engine mechanic's tool set, new short block, necessary parts and equipment.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983

12.0 **COMPETENCY/SKILL:** Overhauls the engine of tractors and traction units needed for agricultural operations.

12.15 **TASK:** Replaces crankshaft seals.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a mechanic's tool set and a seal driver,

EVALUATION: install front oil seal.

STANDARD: The seal must be fully installed in a clean bore and correctly fitted around crankshaft. All parts must be reinstalled in good order, with no leaks present.

STUDENT LEARNING EXPERIENCES:

1. Explain how to remove old seal from timing cover and clean bore.
2. Explain the necessity of applying a light coat of appropriate sealing compound to the outer surface of new seal.
3. Demonstrate how to drive seal in place with correct size seal installer, being sure the seal seats fully.
4. Demonstrate how to reinstall timing cover with appropriate gasket, sealer, etc., being very careful not to damage the seal as it fits over end of crankshaft.
5. Explain how to torque timing cover bolts to specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on crankshafts in the appropriate shop manual or manufacturer's service manual and make a note of the torque specifications for the timing cover.
2. Install the front oil seal in the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, seal driver, necessary equipment and replacement parts, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983

12.0 **COMPETENCY/SKILL:** Overhauls the engine of tractors and traction units needed for agricultural operations.

12.16 **TASK:** Replaces freeze plugs.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a mechanic's tool set, service manual, needed parts and equipment,

EVALUATION: replace freeze plugs.

STANDARD: Old freeze plugs must be removed without damage to the engine block and new freeze plugs must be installed to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper shop safety procedures.
2. Disassemble sheet metal units.
3. Remove freeze plugs.
4. Drill a hole in the center of the freeze plugs, and pry them out using a drift or special puller.
5. Reinstall new freeze plugs.
6. Reassemble sheet metal units.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Remove and replace freeze plugs on the designated tractor engine.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, necessary replacement parts and equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983

13.0 **COMPETENCY/SKILL:** Services/repairs the air and exhaust system of tractors and traction units needed for agricultural operations.

13.1 **TASK:** Cleans and replaces air filter. (dry-element)

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operator's manual, necessary tools, dry-element filter, rags, and a tractor equipped with a dry-element air cleaner,

EVALUATION: service the dry-element air cleaner.

STANDARD: The air cleaner must be clean, a new element must be correctly installed, and the dust unloader must be empty upon completion of service.

STUDENT LEARNING EXPERIENCES:

1. Discuss the procedure recommended by various manufacturers for servicing dry-element air cleaners.

2. Service a dry-element air cleaner according to manufacturer's recommendation.

3. Replace the filter element in the cleaner.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Respond to the following:
   A. Why is an air cleaner inportant?
   B. List three of the most common types of cleaners
   C. What are six maintenance rules for good air cleaner operation?
   D. What are three occasions when you should replace the filter elements?

2. Service a dry-element air cleaner.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, necessary tools, dry-element filter, rags, and tractor equipped with a dry-element air cleaner.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983

13.0 **COMPETENCY/SKILL:** Services/repairs the air and exhaust system of tractors and traction units needed for agricultural operations.

13.1.1 **TASK:** Cleans and replaces air filter. (oil-bath)

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operator's manual, necessary tools and supplies, and a tractor equipped with an oil-bath air cleaner,

EVALUATION: service the oil-bath air cleaner.

STANDARD: The service must include acceptable completion of all steps in the instructor checklist. The oil-bath air cleaner must be correctly installed with clean oil of recommended viscosity. The outer and inner cups must be free of any sediment deposit when job is complete.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing oil-bath air cleaners.
2. List the steps recommended by manufacturers for servicing oil-bath air cleaners.
3. Service oil cleaner with recommended viscosity oil.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Answer the following questions:

   A. Why must oil-bath air cleaners be properly maintained?
   B. What will happen if the air flow through the air cleaner is restricted?
   C. What will happen if dirty air goes directly to the engine cylinder?
   D. List six good maintenance rules for good air cleaner operation.
   E. What steps would you use in servicing an oil-bath air cleaner?

2. Service an oil-bath air cleaner according to recommendations of the manufacturer.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, necessary tools and supplies, and tractor equipped with oil-bath air cleaner.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983

13.0 **COMPETENCY/SKILL:** Services/repairs the air and exhaust system of tractors and traction units needed for agricultural operations.

13.2 **TASK:** Replaces muffler.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the service manual, mechanic's tool set, and replacement muffler,

EVALUATION: replace muffler on designated tractor.

STANDARD: The replaced muffler must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss shop safety precautions.
2. Describe the two common types of mufflers.
3. Discuss damage caused by faulty exhaust systems.
4. Demonstrate how to remove and replace muffler.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss how to clean a spark-arresting muffler.
2. Following demonstration, have students remove and replace muffler on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement muffler, and tractor.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: PREVENTIVE MAINTENANCE. John, IL: Deere and Company, Moline, IL. 1976.

13.0 **COMPETENCY/SKILL:** Services/repairs the air and exhaust system of tractors and traction units needed for agricultural operations.

13.3 **TASK:** Replaces exhaust manifold gasket.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment, sealants,

EVALUATION: replace exhaust manifold gasket on designated tractor.

STANDARD: Install exhaust manifold gasket in such a manner that all parts are installed with no leaks and torqued to service manual specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper shop safety procedures.
2. Replace exhaust manifold gasket (inline engines).
3. Clean all gasket surfaces.
4. Check for cracks.
5. Check heat riser and alignment. Lay straight edge on manifold to head surface to check. If misaligned, loosen center bolts where intake and exhaust manifolds join. Do not tighten until assembly is bolted to head, then retighten.
6. Install finger tight.
7. Check that pilot, or locating rings and gaskets are in place.
8. Torque to specifications in proper sequence.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Install/replace exhaust manifold gasket on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed replacement parts and equipment, sealants, and tractor.

RESOURCES:

Jacobs, Clinton O., Mervin Stearns, Keith E. Mattox. FARM TRACTOR MAINTENANCE: A UNIT OF INSTRUCTION OF FARM TRACTOR MAINTENANCE FOR VOCATIONAL AGRICULTURE. Department of Agricultural Education, University of Arizona, Tucson, AZ. 1975.

13.0 **COMPETENCY/SKILL:** Services/repairs the air and exhaust system of tractors and traction units needed for agricultural operations.

13.4 **TASK:** Services/repairs, or replaces turbocharger.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the service manual, mechanic's tool set, a gasket scraper, torque wrench, and dial indicator with plugger extension,

EVALUATION: service the turbocharger on the designated tractor.

STANDARD: Replaced or reinstalled unit must meet manufacturer's specifications. The following steps must be completed with 100% accuracy: Remove turbocharger, clean manifold connection, inspect blades, check radial bearing play, check shaft play, reinstall turbocharger, check all connections.

STUDENT LEARNING EXPERIENCES:

1. Describe a turbocharger.

2. Discuss the function of a turbocharger.

3. Cite six steps that periodic inspections of a turbocharger should involve.

4. Demonstrate how to perform the procedural steps involved in servicing a turbocharger.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Respond to the following:

   A. What is a turbocharger?
   B. What is the function of a turbocharger?
   C. What are the six steps that should be involved in the periodic inspection of a turbocharger?

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, gasket scraper, torque wrench, dial indicator with plugger extension, and turbocharged tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983

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13.0 **COMPETENCY/SKILL:** Services/repairs the air and exhaust system of tractors and traction units needed for agricultural operations.

13.5 **TASK:** Replaces innercooler.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, torque wrench, and replacement innercooler,

EVALUATION: replace innercooler on designated tractor.

STANDARD: Replaced innercooler unit must meet manufacturer's specifications. All steps specified by the instructor must be completed with 100% accuracy.

STUDENT LEARNING EXPERIENCES:

1. Discuss shop safety precautions.
2. Describe an innercooler equipped turbocharger.
3. Discuss the function of an innercooler.
4. Cite six steps that periodic inspection of a turbocharger should involve.
5. Demonstrate how to perform the procedural steps involved in replacing an innercooler.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Consult the appropriate shop manual and replace the innercooler on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, torque wrench, replacement innercooler, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983

13.0 **COMPETENCY/SKILL:** Services/repairs the air and exhaust system of tractors and traction units needed for agricultural operations.

13.6 **TASK:** Installs flex hose.

PERFORMANCE OBJECTIVE:

See Task 13.4.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

13.0 **COMPETENCY/SKILL:** Services/repairs the air and exhaust system of tractors and traction units needed for agricultural operations.

13.7 **TASK:** Installs turbocharger manifold coupler.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the service manual, mechanic's tool set, a gasket scraper, torque wrench, and dial indicator with plugger extension,

EVALUATION: service the turbocharger on the designated tractor.

STANDARD: Replaced or reinstalled unit must meet manufacturer's specifications. All of the following steps will be completed with 100% accuracy:

1. Removed turbocharger.
2. Cleaned manifold connection.
3. Inspected blades.
4. Checked radial bearing play.
5. Checked shaft play.
6. Reinstalled turbocharger.
7. Checked all connections.

STUDENT LEARNING EXPERIENCES:

NOTE: Internal service of a turbocharger is not recommended. Most service is done with a new or rebuilt unit.

1. Remove air intake lines from turbocharger.

2. Remove adapter air lines, exhaust elbow and other loose connections.

3. Unbolt turbocharger and remove from exhaust manifold.

4. Clean manifold completely of old gasket.

5. Inspect the blades of the turbocharger through the housing and end openings. (Blades should not be bent or broken because this causes problems in balance.)

6. Using a dial indicator with plunger extension, check radial bearing play through air outlet port while moving both ends of turbine shaft equally.

7. Check shaft end-play with dial indicator. If side or end-play exceeds manufacturer's specifications, replace the unit.

8. Replace the turbocharger on the exhaust manifold with a new gasket installed. Torque to specified tightness.

9. Reinstall air lines, outlet lines, and adapter between turbocharger and exhaust elbow. Make sure parts are aligned perfectly, adapter rotates freely and adapter has at least 1/16" free play.

10. Put air lines back on turbocharger and check all connections for tightness. (Note: Never start the reworked turbocharger until there is engine oil in the turbocharger bearing.)

11. Pull the engine stop and crank the engine until the air pressure gauge shows a working range of oil pressure.

12. Start engine and let run at 1000 RPM for 5 minutes to make sure bearing is well lubricated before operating at high idle.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Complete the following questions.

   A. What is a turbocharger?

   B. What is the function of a turbocharger?

   C. Periodic inspection of a turbocharger should involve what six steps?

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, gasket scraper, torque wrench, dial indicator with plugger extension, and turbocharged tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

14.0 **COMPETENCY/SKILL:** Services/repairs the air conditioning system of tractors and traction units needed for agricultural operations.

14.1 **TASK:** Tests system for leaks.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: test system for leaks.

STANDARD: All parts and connections must be clean. The system must operate to manufacturer's specifications and no leakage should occur.

STUDENT LEARNING EXPERIENCES:

1. Discuss the use of proper safety precautions when servicing the air conditioning system.

2. Connect the manifold gauge set.

3. Close high and low side manifold hand valves.

4. Note pressure reading. (340kPa) (3.4 bar) 50 psi is necessary to detect leaks. If pressure is lower than (340 kPa) (3.4 bar) 50 psi refrigerant must be added. To do this:

   A. Attach center manifold hose to the refrigerant container and purge hoses of air.

   B. Open the refrigerant container service valve and both manifold valves until (340 kPa) (3.4 bar) 50 psi is reached.

   C. Close both manifold valves and refrigerant service valve.

5. Move sampling end of detector used from point to point and examine all joints and connections and any other possible leak point. Since refrigerant is heavier than air, it is best to place the ampling end of the detector beneath the point being tested. Do not move sampling end of detectior faster than 25.4 mm (1 inch) per second.

6. After locating the leak, discharge the system of refrigerant. Repair leak.

7. Check compressor oil and add if necessary.

8. Add refrigerant and recheck for leaks. If no leaks are present, evacuate and charge system.

   NOTE: Several types of leak detectors are available to the service technician. Carefully follow manufacturer's instructions when using any detector.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the use of proper safety precaution when servicing the air conditioning system.

2. Identify the causes for the need to test the system for leaks.

3. Following a demonstration, have students test the air conditioning system for leaks on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, refrigerant, and air conditioned equipped tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

14.0 **COMPETENCY/SKILL:** Services/repairs the air conditioning system of tractors and traction units needed for agricultural operations.

14.2 **TASK:** Charges system with freon.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: charge air conditioning system with freon (refrigerant) on designated tractor.

STANDARD: All parts and connectins must be clean. The system must operate to manufacturer's specifications and no leakage should occur.

STUDENT LEARNING EXPERIENCES:

1. Discuss the use of proper safety precaution when servicing the air conditioning system.

2. Check all components, joints and line connections for leakage with a leakage detector.

   NOTE: Check low and high sides with engine "OFF". Repeat check on high side with compressor operating. Any damp, dusty spot indicates a leak.

3. Connect freon container to gauge manifold. Purge air from charging hose.

4. With compressor "OPERATING" add freon until bubbles disappear in receiver--drier sight glass, then add (230 ml) 8 oz. more. Repeat as necessary.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the use of proper safety precaution when servicing the air conditioning system.
2. Identify the causes for the need to charge the air conditioning system.
3. Following a demonstration, have students charge the air conditioning system with freon on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, refrigerant, needed parts and equipment, and tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

14.0 **COMPETENCY/SKILL:** Services/repairs the air conditioning system of tractors and traction units needed for agricultural operations.

14.3 **TASK:** Replaces expansion valve.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace expansion valve on designated tractor.

STANDARD: Replaced expansion valve must meet manufacturer's specifications. All parts must be clean, if dirty, replace receiver-dryer.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper safety precaution when servicing/repairing agricultural power equipment.
2. Explain the need for replacing expansion valve.
3. Discharge system pressure.
4. Remove two roof hold down screws, if installed.
5. Loosen screw on left hand side of roof.
6. Raise roof. Prop up roof with two support rods and spring pin on early models, or one piece rod on later models. Insert bottom of one piece rod into molded in support hold of inner roof and install spring pin.
7. Remove screws, and remove inner front cover.
8. Remove insulation from sensing bulb and expansion valve.
9. Disconnect equalizer line fitting, loosen expansion valve fittings, and remove valve.

   IMPORTANT: Be careful not to kink or pinch sensing tube. Check screen in valve inlet and clean as required. If dirty, replace receiver-dryer. Keep openings capped to keep out contamination.

10. Replace valve if damaged or inoperative.

    NOTE: To assure proper operation, check evaporator pipe and sensing bulb to make sure they are clean and making good contact.

11. Wrap valve, sensing bulb, and surrounding areas with insulating tape.

12. Evacuate and charge the cooling system.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss proper safety precaution when servicing/repairing agricultural power equipment.

2. Study the chapter on air conditioning system in the appropriate shop manual or manufacturer's service manual, and discuss the need to replace expansion control valve.

3. Replace expansion control valve on designated tractor to manufacturer's specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

14.0 **COMPETENCY/SKILL:** Services/repairs the air conditioning system of tractors and traction units needed for agricultural operations.

14.4 **TASK:** Repairs/replaces dryer.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: repair/replace dryer on designated tractor.

STANDARD: Repaired/replaced dryer must meet manufacturer's specifications. All parts must be clean.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper safety precaution when servicing/repairing agricultural power equipment.

2. Explain the need for replacing receiver-dryer.

3. Discharge system pressure.

4. Disconnect inlet and outlet fittings.

   NOTE: Observe exact direction in which sight glass opening is pointing, to assure correct location when installing receiver-dryer.

5. Remove clamp bolts, and remove receiver-dryer. Replace if it has been in service two or more years, or if system is contaminated.

   IMPORTANT: Keep receiver-dryer openings capped until installed, and install last if other components are replaced.

6. Install receiver-dryer.

7. Evacuate and charge the system.

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SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss proper safety precaution when servicing/repairing agricultural power equipment.

2. Study the chapter on air conditioning system in the appropriate shop manual or manufacturer's service manual, and discuss the need to replace the receiver-dryer.

3. Replace receiver-dryer on designated tractor to manufacturer's specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

14.0	**COMPETENCY/SKILL:**	Services/repairs the air conditioning system of tractors and traction units needed for agricultural operations.

14.5 **TASK:** Replaces hose.

PERFORMANCE OBJECTIVE:

See Task 14.10.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

14.0 **COMPETENCY/SKILL:** Services/repairs the air conditioning system of tractors and traction units needed for agricultural operations.

14.6 **TASK:** Cleans evaporator.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: clean evaporator on designated tractor.

STANDARD: Worn or damaged parts must be repaired or replaced. All parts and connections msut be clean. The system must operate to manufacturer's specifications and no leakage should occur.

STUDENT LEARNING EXPERIENCES:

1. Discuss the use of proper safety precaution when servicing the air conditioning system.
2. Clean evaporator.
3. Test evaporator core using a maximum of 345 kPa (50 psi) pressure. Replace if there are any restrictions, or leaks which cannot be repaired.
4. Check and clean condensate drain tray under evaporator, and make sure drain hoses are open. If water is leaking around packing, break out tube and remove bushing.
5. Install new packing on bushing, insert bushing in hole, and push new tube through bushing until it locks in place. Replace drain hoses if cracked or split, route the same as old hose.
6. If evaporator oil was flushed, or if a new evaporator is installed, pour 45 ml (1.5 fluid oz.) of 525 viscosity oil into evaporator core.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the use of proper safety precaution when servicing the air conditioning system.

2. Identify the causes for the need to clean/repair evaporator.

3. Clean/repair evaporator on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

14.0 **COMPETENCY/SKILL:** Services/repairs the air conditioning system of tractors and traction units needed for agricultural operations.

14.7 **TASK:** Replaces evaporator.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, replacement evaporator and needed parts,

EVALUATION: replace evaporator on designated tractor.

STANDARD: All parts must be clean, and replaced evaporator must operate to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the use of proper safety precaution when servicing/repairing tractors or traction units.
2. Explain the need for replacing evaporator.
3. Remove evaporator.
4. Install new evaporator.
5. Remove caps from evaporator core openings and reinstall according to manufacturer's instructions.
6. To assure proper operation, check evaporator pipe and sensing tube. Make sure they are clean and make good contact, wrap valve, bulb, and surrounding pipes with insulating tape.
7. Insert temperature control switch sensing tube full depth between first and second refrigerant tubes, 381 mm (15 in.) from left hand side of core. If frosting of core is a problem, move tube closer to left hand side of core; if system cycles too often, particularly in low humidity climates, move tube farther to right hand side of core.
8. Connect hoses and fill engine cooling system.
9. Start engine and run long enough to purge air from heating system. If air remains in system, loosen one of the hoses at heater valve to allow air to escape.
10. Evacuate and charge cooling system.
11. Leak check the system.
12. Perform operational test.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss proper safety precautions when servicing/repairing agricultural power equipment.

2. Study the chapter on air conditioning system in the appropriate shop manual or manufacturer's service manual, and discuss the need to replace the evaporator.

3. Replace evaporator on designated tractor to manufacturer's specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement evaporator and needed parts, and tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

14.0 **COMPETENCY/SKILL:** Services/repairs the air conditioning system of tractors and traction units needed for agricultural operations.

14.8 **TASK:** Cleans condenser.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, needed cleaning materials and equipment,

EVALUATION: clean condenser on designated tractor.

STANDARD: The condenser must be clean and have no air flow restriction. The air conditioning system must operate to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the primary causes of condenser malfunction.
2. Using materials and equipment, clean condenser on designated tractor.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study Air Conditioning System Test and Diagnosis in manufacturer's service manual.
2. Idenify cause for the need to keep condenser clean.
3. Clean condenser on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, cleaning materials, needed equipment, and tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

14.0 **COMPETENCY/SKILL:** Services/repairs the air conditioning system of tractors and traction units needed for agricultural operations.

14.9 **TASK:** Replaces condenser.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace/repair condenser on designated tractor.

STANDARD: All parts must be clean. Condenser must be torqued to recommended specifications. The air conditioning system must operte to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper safety precautions when servicing/repairing agricultural power equipment.
2. Explain the need for replacing condenser.
3. Discharge system pressure.
4. Disconnect air conditioning system inlet and outlet hoses.
5. Disconnect hydrostatic oil cooler hoses.

   IMPORTANT: Remove hose clamps and inspect spring and ball in bypass valve. Assemble valve with spring pin UP (chamfered middle of valve body DOWN) when hoses are connected to cooler core.

6. Release latch, swing core out, loosen two top screws, and lift core out.

   NOTE: Core is heavy and will fall when latches are released. use care to avoid damaging condenser core.

7. Drain and measure the oil in the condenser. Record the amount.
8. Cap condenser and hose fittings to keep out dirt and moisture.
9. If contamination is evident in condenser, flush the system.
10. Examine condenser for restrictions or damage. Be sure pins are striaght and free of dirt, trash, or corrosion. Clean as needed.
11. To test for leaks, cap outlet and pressurize the condenser core with refrigerant, using a Schrader valve at the inlet fitting.

12. Connect refrigerant container to inlet fitting and heat container to (52* C) 125* F maximum in a pail of water. Use a leak detector to check for leaks. Replace condenser if leaks are found.

13. Keep opening of condenser capped until it is installed.

14. If condenser was flushed, or a new one is installed, pour (56 ml) 2 fluid oz. into the core through a fitting.

    NOTE: If system was flushed, or additonal components were repaired, refer to section in service manual to add refrigerant oil to system.

15. Install condenser and torque to specifications.

16. Evacuate and charge the system.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss proper safety precautions when servicing/repairing agricultural power equipment.

2. Study the chapter on air conditioning system in the appropriate shop manual or manufacturer's service manual, and discuss the need to replace the condenser.

3. Replace condenser on designated tractor to manufacturer's specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement condenser, needed parts and equipment, and tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

14.0 **COMPETENCY/SKILL:** Services/repairs the air conditioning system of tractors and traction units needed for agricultural operations.

14.10 **TASK:** Replaces compressor.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace compressor on designated tractor.

STANDARD: All parts and connections must be clean. The air conditioning system must operate to manufacturer's specifications and no leakage should occur.

STUDENT LEARNING EXPERIENCES:

CAUTION: New and rebuilt compressors are charged with nitrogen, refrigerant, and oil. Remove cover plate SLOWLY to prevent oil from blowing out.

IMPORTANT:

1. Keep openings of stock compressors capped to keep out dirt and moisture. If charge is lost, recharge with refrigerant.
2. Be sure to install correct amount of oil recommended by manufacturer. Rotate compressor shaft 4 or 5 times to lubricate seal. Wipe oil from surface of compressor to keep it out of compressor clutch.
3. If compressor seized, or failed due to broken parts, refer to service manual.

1. Discuss the use of proper safety precaution when servicing the air conditioning system.
2. Remove damaged compressor.
3. Install replacement compressor.

   IMPORTANT: Be sure to use standard or metric hardware as required if new or rebuilt unit is installed.

4. Coat compressor manifold O-rings with CLEAN refrigerant oil, install fittings, and torque cover plate center screw to 34 N.m (25 lb-ft). If fittings are unequal in height, tighten additional screw to seat short fitting, and tighten lock nut.

5. Loosen screws. using belt tension gauge, tighten compressor drive belt to 445 N (100 lb) if new, or to 378-423 N (85-94 lb) after run-in. Tighten screws.

   NOTE: Check new belt after at least 10 minutes use, allow to cool at least 10 minutes, and adjust tension.

6. Evacuate and charge the system.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the use of proper safety precaution when servicing the air conditioning system.

2. Identify the causes for the need to replace the compressor.

3. Following a demonstration, have students replace compressor on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement compressor, needed parts and equipment, and tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

14.0 **COMPETENCY/SKILL:** Services/repairs the air conditioning system of tractors and traction units needed for agricultural operations.

14.11 **TASK:** Installs compressor belt.

PERFORMANCE OBJECTIVE:

See Task 14.12.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

14.0 **COMPETENCY/SKILL:** Services/repairs the air conditioning system of tractors and traction units needed for agricultural operations.

14.12 **TASK:** Rebuilds compressor clutch.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: rebuild compressor clutch on designated tractor.

STANDARD: Working area and all parts must be clean. The system must operate to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss how to keep working area clean at all times.
2. Discuss proper safety precaution when servicing/repairing agricultural power equipment.
3. Demosntrate how to follow service manual procedures for rebuilding the compressor clutch.
4. Demonstrate how to disassemble and reassemble compressor clutch according to directions in the service manual. Replace all worn or damaged parts as necessary.

   CAUTION: Loosen fittings slowly, to prevent rapid discharge of oil and refrigerant from the system.

   IMPORTANT: Clean area around shaft and seal thoroughly before disassembly.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss proper safety precaution when servicing/repairing agricultural power equipment.

2. Study chapter on air conditioning system in service manual or manufacturer's manual and discuss troubleshooting the compressor clutch assembly.

3. Following a demonstration, have students rebuild compressor clutch on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

14.0 **COMPETENCY/SKILL:** Services/repairs the air conditioning system of tractors and traction units needed for agricultural operations.

14.13 **TASK:** Replaces blower motor.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace blower motor on designated tractor.

STANDARD: All parts must be clean and system must operate to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper safety precaution when servicing/repairing agricultural power equipment.
2. Explain the need for replacing blower motor.
3. Remove two tie down screws (if equipped), on each side of roof.
4. Prop up roof.
5. Remove inner front cover.
6. Disconnect blower motor wires.
7. Remove screws securing upper half of housing to lower half.
8. Remove retaining clips and lift off upper housing half.
9. Lift impeller and motor assembly out of lower housing half.
10. Remove retaining clips, and remove impellers.
11. Replace motor.

    IMPORTANT: Replace impeller if cracked, to prevent it from flying apart during operation.

12. Install impellers with fins curved in the same direction as the motor rotates.

    NOTE: Use a short piece of pipe inside of impeller to drive hub on shaft, if necessary, to avoid damage to impeller.

13. Install blower assembly in housing and route wires through notch in housing.

14. If necessary, adjust impeller positions on shaft to allow them to spin freely.

15. Connect blower motor wires.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss proper safety precaution when servicing/repairing agricultural power equipment.

2. Study chapter on air conditioning system in service manual or manufacturer's manual and discuss troubleshooting the pressurizer blower.

3. Following a demonstration, have students replace blower motor on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement part, and tractor.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T-M 1356 (SEP-85). John Deere and Company, Moline, IL. 1985.

15.0 **COMPETENCY/SKILL:** Services/repairs wheels of traction units needed for agricultural operations.

15.1 **TASK:** Adjusts spacing.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operator's manual, mechanic's tool set, a set of jacks and wheel-blocks,

EVALUATION: adjust front-wheel spacing.

STANDARD: Adjusted front-wheel spacing must be in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate proper safety precautions while jacking up a vehicle.
2. Adjust spacing.
3. Raise the front of the tractor, using a wide-base jack.
4. Make sure the tractor is on a level surface.
5. Block both rear wheels in both directions.
6. Determined the desired tread.
7. Remove the axle adjusting bolts and loosen or remove the bolts holding the tie-rod drag links.
8. Slide the axles in or out to the desired position.
9. Line up the adjusting holes.
10. Insert the bolts and tighten them securely.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the need for front-wheel spacing adjustments.
2. Following demonstration, have students adjust front-wheel spacing on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, mechanic's tool set, a set of jacks and wheel-blocks, and tractor.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: TRACTORS. John Deere and Company, Moline, IL. 1974.

15.0 **COMPETENCY/SKILL:** Services/repairs wheels of traction units needed for agricultural operations.

15.2 **TASK:** Replaces duals.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a tractor equipped with dual tires, mechanic's tool set, needed parts and equipment,

EVALUATION: replace duals.

STANDARD: Replaced dual rear tires must be installed in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate proper safety precautions while jacking up a vehicle.
2. Explain the variety of arrangements available to attach the outer set of wheels.
3. Explain the comparison of attachments methods.
4. Identify the attachment method used on designated tractor.
5. Replace dual rear tires.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss operational differences between tractors equipped with single-rear tires and dual-rear tires.
2. Following demonstration, have students replace dual rear tires on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, set of jacks, wheel blocks, mechanic's tool set, needed parts and equipment, a tractor equipped with dual rear tires.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: TRACTORS. John Deere and Company, Moline, IL. 1974.

15.0 **COMPETENCY/SKILL:** Services/repairs wheels of traction units needed for agricultural operations.

15.3 **TASK:** Fills with ballast.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given fluid-inflated tires, service manual, jack, tire pressure gauge, hose and adapter,

EVALUATION: service the tire with air and fluid.

STANDARD: Tire pressure must not exceed the manufacturer's specified pressure and the fluid must be added to the recommended level.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate proper safety precautions while jacking up a vehicle.
2. Explain the need for removing the valve core.
3. Explain how to rotate the tire until the valve stem is at the twelve o'clock position.
4. Demonstrate how to start the fluid.
5. Explain how to get the fluid to come out, air bleed.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate the procedure for servicing tires with fluid.
2. Practice servicing tires with fluid.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, jack, wheel-blocks, tire pressure gauge, hose and adapter, fluid-inflated tires, and tractor.

RESOURCES:

Walker, Hattie M., et.al.. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983

15.0 **COMPETENCY/SKILL:** Services/repairs wheels of traction units needed for agricultural operations.

15.4 **TASK:** Changes tires.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a large implement tire, hammer, bead-breaking tool, lubricant, and clean tire irons,

EVALUATION: demount large implement tire.

STANDARD: The tire must be demounted without damage to the rim, tire, or tube.

STUDENT LEARNING EXPERIENCES:

1. Explain how to remove a tire or wheel assembly.
2. Discuss the procedure for breaking the bead.
3. Discuss the need to lubricate the rim flange, tire bead, and base of tube.
4. Explain the difference between working with small tires and large tires.
5. Demonstrate how to follow procedural steps to demount large implement tires.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Observe a demonstration of the demounting of a large tire.
2. Following demonstration, have students practice demounting large implement tires.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, hammer, bead-breaking tool, lubricant, clean tire irons, large implement tire.

RESOURCES:

Walker, Hattie M., et.al.. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983

15.0 **COMPETENCY/SKILL:** Services/repairs wheels of traction units needed for agricultural operations.

15.5 **TASK:** Aligns front wheels.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operator's manual, and a mechanic's tool set,

EVALUATION: align front wheels on designated tractor.

STANDARD: Front wheel alignment must be in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper safety precautions used when servicing/repairing agricultural power and machinery.
2. Align front wheels.
3. Turn the steering wheel until the front wheels point straight ahead, parallel to the center line of the tractor.
4. Measure the distance from the center line of one tire to the center line of the other tire, first at the front and then at the back. In most cases, the front measurement should be 1/8 to 3/8 inch less than the rear measurement.
5. If the alignment is not correct, adjust the tie rod until the measurement is correct.
6. Tighten the tie rods.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the steering and tracking of the tractor.
2. Following demonstration, have students align front wheels on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, mechanic's tool set, needed parts and equipment, and tractor.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: TRACTORS. John Deere and Company, Moline, IL. 1974.

15.0 **COMPETENCY/SKILL:** Services/repairs wheels of traction units needed for agricultural operations.

15.6 **TASK:** Installs wheel weights.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operator's manual, mechanic's tool set, necessary parts and equipment,

EVALUATION: install wheel weights.

STANDARD: Installed wheel weights must be in compliance with manufacturer's recommendations.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate proper safety precautions while installing wheel weights.
2. Explain the various wheel-weight mounting methods utilized by tractor manufacturers.
3. Identify the attachment method to use on designated tractor.
4. Install wheel weights.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the various methods utilized to add weight to tractor.
2. Following demonstration, have students install rear wheel weights on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, jack, wheel-blocks, mefhanic's tool set, necessary parts and equipment, and tractor.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: TRACTORS. John Deere and Company, Moline, IL. 1974.

15.0 **COMPETENCY/SKILL:** Services/repairs wheels of traction units needed for agricultural operations.

15.7 **TASK:** Replaces wheel spindle.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, necessary parts and equipment,

EVALUATION: replace wheel spindle.

STANDARD: Replaced wheel spindle must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate proper safety precautions while installing wheel spindle.
2. Explain the various types of spindles utilized on front axles.
3. Identify the type spindle design on designated tractor.
4. Replace wheel spindle.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the type of spindles utilized on front axles.
2. Following demonstration, have students install wheel spindle on front axle of designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, necessary parts and equipment, and tractor.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: TRACTORS. John Deere and Company, Moline, IL. 1974.

15.0 **COMPETENCY/SKILL:** Services/repairs wheels of traction units needed for agricultural operations.

15.8 **TASK:** Replaces bearings.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, replacement parts, number 2 lithium grease, and shop rags,

EVALUATION: pack the wheel bearings on designated tractor.

STANDARD: There must be no drag or end play. The following steps must be completed acceptably: Brakes locked; front end blocked, damaged parts replaced, if needed; bearings packed satisfactorily; bearings installed and assembled.

STUDENT LEARNING EXPERIENCES:

1. Explain why it is important to keep the wheel bearings and surrounding area free from dirt.
2. Discuss why the bearings should never fall on the ground or floor.
3. List the steps for cleaning the wheel bearings.
4. List the steps for replacing and assembling the bearings.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Consult the operator's manual or appropriate shop manual for instructions in dismantling the front system of the tractor, and discuss the same.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, number 2 lithium grease, shop rags, jacks, wheel-blocks, and tractor.

RESOURCES:

Walker, Hattie M., et.al.. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983

15.0 **COMPETENCY/SKILL:** Services/repairs wheels of traction units needed for agricultural operations.

15.9 **TASK:** Replaces wheels.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace wheels.

STANDARD: Replaced wheels must be installed with tread bars pointing to the rear where the tire is in contact with the ground.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate proper safety precautions while replacing wheels.

2. Securely block both front wheels of the tractor to prevent movement in either direction.

3. Place a heavy-duty jack under the differential housing or the drawbar rack.

4. Make sure that the surface of the tractor the jack is placed under is flat and strong enough to support the weight of the tractor.

5. Be certain blocks used under the jack are flat, and rest solidly on the ground.

6. After the rear of the tractor is raised, place blocks to solidly support both rear-axles of the tractor before working on the wheels. Sliding wheels on and off the tractor can cause it to wobble and fall from the jack if not securely blocked.

7. Clean all mud and dirt from the portion of the axles over which the wheels will slide after blocking the tractor axles. It may also help to oil or grease the axles to aid in removing the wheels.

8. Loosen the bolts holding the split hubs of the wheels together.

9. Remove and replace wheels.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss safety supports and proper procedures to use when changing tractor wheels.
2. Following demonstration, have students change wheels on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, jack, wheel-blocks, needed parts and equipment, and tractor.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: TRACTORS. John Deere and Company, Moline, IL. 1974.

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16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.1 **TASK:** Replaces alternator/generator.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, and replacement part,

EVALUATION: replace alternator/generator.

STANDARD: The replaced alternator/generator must be installed so that all pulleys are aligned, belts at recommended tension, and alternator/generator output is sufficient to charge the battery.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of replacing electrical equipment.
2. Discuss the reasons for the need to replace an alternator.
3. Explain the manufacturer's specifications for replacing an alternator or generator.
4. Demonstrate how to align pulleys.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Participate in a class discussion of procedural steps involved in replacing an alterntor or generator.
2. Test an alternator/generator for the need to be replaced.
3. Replace an alternator/generator on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement part, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.2 **TASK:** Replaces alternator/generator.

PERFORMANCE OBJECTIVE:

See Tasks, 10.8, and 16.1.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

16.3 **TASK:** Replaces alternator/generator.

PERFORMANCE OBJECTIVE:

See Task 16.4.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.4 **TASK:** Replaces battery.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a new battery, battery pliers, and socket wrench set,

EVALUATION: replace battery.

STANDARD: Tighten battery cables and battery hold-down clamps so that neither the cables nor battery will move when pressure is applied.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of replacing a battery.

2. Discuss the procedure outlined in the service manual for removing and replacing a battery.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Respond to the following:

   A. Why should you never hammer loose battery clamps in place?
   B. What is the recommended tool for tightening the hold-down clamps?
   C. What will happen if the battery has a loose terminal?

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, battery pliers, socket wrench set, replacement battery, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.5 **TASK:** Checks/replaces battery fluids.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a wet-cell battery and a hydrometer,

EVALUATION: check/replace battery fluids.

STANDARD: The hydrometer reading must be the same as the instructor's reading on each cell and the electrolyte level should be 3/8 inch above plate.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a wet-cell battery.
2. List steps involved in charging a wet-cell battery.
3. Check/replace battery fluids.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students check/replace battery fluids on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, hydrometer, distilled water, and wet-cell battery.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.6 **TASK:** Installs radio.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given necessary tools, equipment, and operator's manual,

EVALUATION: install radio on the designated tractor.

STANDARD: The radio must be installed and operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss how to remove all parts necessary to install radio.
2. Demonstrate how to bolt new assembly in place.
3. Demonstrate how to solder radio wiring.
4. Test radio for reception.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Check service manual for correct wire size.
2. Install radio on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, mechanic's tool set, radio, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.7 **TASK:** Replaces wiring harness.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given necessary tools, equipment, wiring harness, and operator's manual,

EVALUATION: repair/replace wiring harness on designated tractor.

STANDARD: Wire size and resistance reading must be 100% accurate, as indicated by manufacturer's specifications. The repaired wiring harness must be properly connected.

STUDENT LEARNING EXPERIENCES:

1. Identify the causes of the need to replace a damaged wiring harness.

2. Discuss the steps involved in repairing the wiring harness.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Check service manual for correct wire size.

3. Following a demonstration, have students repair the wiring harness on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, mechanic's tool set, necessary equipment, wiring harness, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.8 **TASK:** Replaces flasher relay.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given necessary tools, equipment, replacement flasher relay, and operator's manual,

EVALUATION: replace flasher relay.

STANDARD: The flasher relay must be properly connected and operate to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Identify the causes of the need to replace a flasher relay.
2. Discuss the steps involved in replacing a flasher relay.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Check service manual for correct flasher relay size.
2. Replace flasher relay on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, mechanic's tool set, necessary equipment, replacement flasher relay, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.9 **TASK:** Replaces solenoid.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a set of ignition wrenches, an open-end wrench set, a D.C. voltmeter, or a multi-meter,

EVALUATION: check a solenoid on designated tractor.

STANDARD: The voltmeter must agree with that of the instructor.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate how to disconnect solenoid-to-starter cable connection from the solenoid.
2. Explain how to connect voltmeter from starter terminal of the solenoid to ground.
3. Demonstrate how to activate switch and observe reading on voltmeter for battery voltage.
4. Demonstrate how to remove and replace solenoid if necessary.
5. Demonstrate how to remove voltmeter and reconnect starter cable.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Check the solenoid on a tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, a set of ignition wrenches, an open-end wrench set, D. C. voltmeter or a multi-meter, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.10 **TASK:** Repairs lights.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given necessary tools, equipment, replacement parts, and operator's manual,

EVALUATION: repair lights.

STANDARD: The repaired lights must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Identify the causes of the need to repair lights.
2. Discuss the steps involved in repairing tractor or traction units.

SUGGESTED INSTRUCTIONAL TECHNIQUES

1. Check service manual for correct seal beam, bulb, or lamp size.
2. Troubleshoot lighting system on the designated tractor.
3. Repair lights on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, necessary tools, equipment, replacement parts, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.11 **TASK:** Replaces oil pressure gauge.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given replacement oil pressure gauge, necessary tools and equipment,

EVALUATION: replace an oil pressure gauge on designated tractor.

STANDARD: The replacement gauge must function properly and the following steps should be completed during the replacement: Remove oil pressure gauge, remove wires, install new wires, mount oil pressure gauge.

STUDENT LEARNING EXPERIENCES:

1. Explain how to secure replacement oil pressure gauge.
2. Demonstrate how to remove oil pressure gauge from mounting.
3. Identify source of wires connecting to oil pressure gauge.
4. Discuss how to remove wires from old gauge and attach to new gauge.
5. Demonstrate how to mount replacement oil pressure gauge.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Replace oil pressure gauge on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement part, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.12 **TASK:** Replaces oil pressure gauge.

PERFORMANCE OBJECTIVE:

See Task 16.10.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.13 **TASK:** Replaces fuel gauge.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given replacement fuel gauge, necessary tools and equipment,

EVALUATION: replace fuel gauge on designated tractor.

STANDARD: The replaced fuel gauge must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Explain how to secure replacement fuel gauge.
2. Demonstrate how to remove fuel gauge from mounting.
3. Identify source of wires connecting to fuel gauge.
4. Discuss how to remove wires from old gauge and attach to new gauge.
5. Demonstrate how to mount replacement fuel gauge.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Replace fuel gauge on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement part, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.14 **TASK:** Replaces engine temperature gauge.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given replacement engine temperature gauge, necessary tools and equipment,

EVALUATION: replace engine temperature gauge on designated tractor.

STANDARD: The replacement engine temperature gauge must function properly and the following steps should be completed during the replacement: Remove engine temperature gauge, remove wires, install new wires, mount engine temperature gauge.

STUDENT LEARNING EXPERIENCES:

1. Explain how to secure replacement engine temperature gauge.
2. Demonstrate how to remove engine temperature gauge from mounting.
3. Identify source of wires connecting to engine temperature gauge.
4. Discuss how to remove wires from old gauge and attach to new gauge.
5. Demonstrate how to mount replacement engine temperature gauge.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Replace engine temperature gauge on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement part, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983..pa

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.15 **TASK:** Replaces hour meter.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given replacement hour meter, necessary tools and equipment,

EVALUATION: replace the hour meter on designated tractor.

STANDARD: The replaced hour meter must function properly and the following steps must be completed during the replacement: Remove hour meter, remove wires, install new wires, and mount new hour meter.

STUDENT LEARNING EXPERIENCES:

1. Explain how to secure replacement hour meter.
2. Demonstrate how to remove hour meter from mounting.
3. Identify source of wires connecting to hour meter.
4. Discuss how to remove wires from old meter and attach to new meter.
5. Demonstrate how to mount replacement hour meter.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Replace the hour meter on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement part, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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16.16 **TASK:** Replaces starter relay.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given necessary tools, equipment, replacement starter relay, and operator's manual,

EVALUATION: replace starter relay.

STANDARD: The replaced starter relay must be properly connected and operate to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Identify the causes of the need to replace a starter relay.
2. Discuss the step involved in replacing a starter relay.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Check service manual for correct starter relay size.
2. Replace starter relay on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, mechanic's tool set, replacement part, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

16.0 COMPETENCY/SKILL: Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.17 TASK: Replaces starter drive.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a new starter drive and mechanic's tool set,

EVALUATION: replace the starter drive on designated tractor.

STANDARD: The following steps must be completed acceptably: Remove starter, remove starter drive, install new drive, install starter, check operation of starter.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate how to perform the following sequenced job skills:

    A. Disconnect the battery ground.
    B. Remove starter.
    C. Remove starter drive (Bendix) from starter shaft.
    D. Install new drive on starter shaft (reassemble starter if necessary).
    E. Reinstall starter.
    F. Reconnect battery ground.
    G. Check operation of starter.

2. Explain when a starter drive should be replaced.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the following:

    a. When should the starter drive be replaced?
    b. Describe the steps that should be followed during installation of a new drive spring.

2. Read the section on starters for designated tractor in either the manufacturer's service manual or the appropriate shop manual.

3. Replace the starter drive on an assigned tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, mechanic's tool set, replacement part, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.18 **TASK:** Replaces starter.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an open-end and box-end wrench set, a socket set, and a new starter,

EVALUATION: replace the starter motor on designated tractor.

STANDARD: The starter must fit correctly and be fastened securely, and all connections should fit tightly. The replacement process must include the acceptable completion of all steps specified by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate how to perform the following sequenced job skills:

    A. Disconnect battery ground cable.
    B. Disconnect cable from starter.
    C. Unbolt starter from engine.
    D. Compare old starter with replacement starter to be sure of correct fit.
    E. Thoroughly clean mount area for good grounding.
    F. Bolt on replacement starter.
    G. Replace starter cable.
    H. Replace battery ground cable.
    I. Check for correct operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Students read the section on starters for the assigned tractor in either the appropriate shop manual or the manufacturer's service manual.

2. Remove and install the starter motor on the assigned tractor, following the outline given in the service manual.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, open-end and box-end wrench set, socket set, new starter, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.19 **TASK:** Installs air-conditioning thermostat switch.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given replacement air-conditioning thermostat switch, necessary tools and equipment,

EVALUATION: replace the air-conditioning thermostat switch on designated tractor.

STANDARD: The air-conditioning thermostat switch must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Explain how to secure replacement air conditioning thermostat switch.
2. Demonstrate how to remove air conditioning thermostat switch from mounting.
3. Identify source of wires connecting to air conditioning thermostat switch.
4. Discuss how to remove wires from old switch and attach to new switch.
5. Demonstrate how to mount replacement air conditioning thermostat switch.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Replace air conditioning thermostat switch on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement part, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.20 **TASK:** Replaces wiring.

PERFORMANCE OBJECTIVE:

See Task 17.7.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.21 **TASK:** Replaces circuit breaker.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given replacement circuit breaker, necessary tools and equipment,

EVALUATION: replace a circuit breaker on designated tractor.

STANDARD: Replaced circuit breaker must be installed and function in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Explain how to secure replacement circuit breaker.
2. Demonstrate how to remove circuit breaker from mounting.
3. Identify source of wires connecting to circuit breaker.
4. Discuss how to remove wires from old circuit breaker and attach to new circuit breaker.
5. Demonstrate how to mount replacement circuit breaker.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Replace a circuit breaker on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement part, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.22 **TASK:** Replaces thermal fuse.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given necessary tools, equipment, replacement thermal fuse, and operator's manual,

EVALUATION: replace thermal fuse on designated tractor.

STANDARD: The replaced thermal fuse must be properly connected and operate to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Identify the causes of the need to replace a thermal fuse.
2. Discuss the steps involved in replacing a thermal fuse.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Check service manual for correct thermal fuse size.
2. Replace thermal fuse on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, mechanic's tool set, replacement part, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

16.0 **COMPETENCY/SKILL:** Services/repairs the electrical system of tractors and traction units needed for agricultural operations.

16.23 **TASK:** Replaces steering motor bearings.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a new set of bearings, a service manual, a mechanic's tool set, and an arbor press,

EVALUATION: replace the steering motor bearings on designated tractor.

STANDARD: When service is complete, the steering motor must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Identify defective bearing.
2. Demonstrate how to disassemble steering motor according to instructions in manufacturer's service manual.
3. Explain how to press defective bearing from housing.
4. Discuss how to press new bearing into housing.
5. Demonstrate how to assemble steering motor.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on replacing bearings in either the manufacturer's service manual or the appropriate shop manual.
2. Replace the bearings in the designated steering motor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, distance-measuring device, the correct open-end wrench, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

17.0 **COMPETENCY/SKILL** Services/repairs the clutch of tractors and traction units needed for agricultural operations.

17.1 **TASK:** Adjusts clutch.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the service manual, a distance-measuring device, the correct open-end wrench, and a clutch on designated tractor,

EVALUATION: adjust the clutch free play.

STANDARD: The adjustment must be made to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Explain how to measure the amount of free play in the clutch pedal arm and compare to specifications in the manufacturer's service manual.

2. Demonstrate how to loosen nuts on the adjusting yoke located at the lower end of the clutch operation rod.

3. Demonstrate how to adjust free play to specification and tighten nuts.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on clutches for the designated tractor in either the appropriate shop manual or the manufacturer's service manual.

2. Respond to the following:

   a. What is the function of a clutch?
   b. Define clutch "free play" or "free travel".
   c. Why should the clutch always have a certain amount of "free travel"?
   d. When would it be alright not to adjust the clutch?

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, distance-measuring device, the correct open-end wrench, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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17.0 **COMPETENCY/SKILL** Services/repairs the clutch of tractors and traction units needed for agricultural operations.

17.2 **TASK:** Replaces clutch disc.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, and the necessary tools and replacement parts,

EVALUATION: service a dry clutch.

STANDARD: When servicing is complete, the clutch must operate according to manufacturer's specifications and there must not be excessive lubrication of the bearing or release fork.

STUDENT LEARNING EXPERIENCES:

1. Discuss what type of power equipment uses dry clutches and why.
2. Discuss the difference between a dry-type disc clutch and a wet-type disc clutch.
3. Explain why too much lubrication should not be used on the clutch pilot bearing.
4. Demonstrate how to service a dry clutch on a tractor.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study the section on clutches in the appropriate shop manual or manufacturer's service manual.
2. Service the dry clutch on the assigned tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, lubricants, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

17.0 **COMPETENCY/SKILL** Services/repairs the clutch of tractors and traction units needed for agricultural operations.

17.3 **TASK:** Replaces clutch seals.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the manufacturer's service manual, new seals, the specified oil, and necessary tools,

EVALUATION: service a wet clutch.

STANDARD: Upon completion, there must be no leaks and the oil level must be to specifications.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate how to check oil level and look for traces of oil leakage.

2. Explain how to disassemble, following directions in the manufacturer's service manual. Check to see that oil circulates properly, lines are clear on units equipped with pumps, and inlet lines or filters are clean. Correct problem if indicated.

3. Discuss how to check (and replace as needed) the oil seals located at the clutch release fork, flywheel, and clutch shaft end of housing.

4. Explain how to reassemble clutch parts.

5. Demonstrate how to check type and grade of oil specified by manufacturer and how to add oil if necessary.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Review the directions outlined in shop manuals for servicing a wet clutch.

2. Service a wet clutch.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, new seals, the specified oil, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

17.0 **COMPETENCY/SKILL** Services/repairs the clutch of tractors and traction units needed for agricultural operations.

17.4 **TASK:** Replaces clutch bushings.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, replacement parts and equipment, solvents, lubricants, and mechanic's tool set,

EVALUATION: replace clutch bushing on designated tractor.

STANDARD: The replaced clutch bushings must meet manufacturer's specifications, and there will not be exessive lubrication of the bearing or release fork.

STUDENT LEARNING EXPERIENCES:

NOTE: Check the manufacturer's service manual for proper equipment and procedure for specified clutch. SPRING PRESSURE MUST BE CONTROLLED AND RELEASED EVENLY TO AVOID INJURY.

1. Discuss proper shop safety procedures.
2. Check clutch release and pressure mechanisms. Pressure should be even around the clutch.
3. Adjust release levers so that contact with release bearing will be uniform and the pressure plate will release evenly.
4. Examine clutch and replace bushings according to manufacturer's specifications.
5. Check clutch for free play.
6. Lubricate the pilot bearing, release bearing and release fork sparingly.
7. Make clutch release adjustment to specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study the section on clutches in the I & T SHOP MANUAL or manufacturer's service manual.

2. Replace clutch bushings on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts and equipment, solvents, lubricants, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

17.0 **COMPETENCY/SKILL** Services/repairs the clutch of tractors and traction units needed for agricultural operations.

17.5 **TASK:** Replaces clutch disk plate.

PERFORMANCE OBJECTIVE:

CONDITIONS: Using the manufacturer's service manual and the necessary tools and replacement parts,

EVALUATION: replace clutch disk plate on designated tractor.

STANDARD: When servicing is complete, the clutch will operate according to manufacturer's specifications, and there will not be excessive lubrication of the bearings or release fork.

STUDENT LEARNING EXPERIENCES:

NOTE: Check the manufacturer's service manual for proper equipment and procedure for specified clutch. SPRING PRESSURE MUST BE CONTROLLED AND RELEASED EVENLY TO AVOID INJURY.

1. Discuss shop safety procedures.

2. Check clutch release and pressure mechanisms (pressure should be even around the clutch).

3. Adjust release levers so that contact with release bearing will be uniform and the pressure plate will release evenly.

4. Examine clutch and rebuild, if necessary, following instructions in the service manual.

5. Check clutch for free play.

6. Lubricate the pilot bearing, release bearing and release fork sparingly.

7. Make clutch release adjustment following instructions in the service manual.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Complete the following questions:

   A. What type of power equipment uses dry clutches and why?
   B. What is the difference between a dry-type disk clutch and a wet-type disk clutch?
   C. Why should you not use too much lubrication on the clutch pilot bearing?

2. Replace clutch dish plate on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts and equipment, solvents, lubricants, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

17.0 **COMPETENCY/SKILL** Services/repairs the clutch of tractors and traction units needed for agricultural operations.

17.6 **TASK:** Replaces clutch springs bearings.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, solvents, lubricants, replacement parts and equipment, mechanic's tool set,

EVALUATION: replace clutch springs bearings on designated tractor.

STANDARD: Disassembly and reassembly must be to manufacturer's specifications. All worn and damaged parts must be repaired or replaced, and the serviced clutch will operate to specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper shop safety procedures.
2. Determine clutch type and specifications by checking the manufacturer's service manual.
3. Disassemble clutch assembly according to instructions in service manual.
4. Inspect, repair or replace any worn or damaged parts.
5. Replace clutch springs bearings.
6. Clean all parts and lubricate with recommended lubricants.
7. Reassemble according to manufacturer's specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Make a list of things to watch for when servicing clutches.
2. Read the section on clutches for the designated tractor in manufacturer's service manual.
3. Replace clutch springs bearings on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts and equipment, solvents, lubricants, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

17.0 **COMPETENCY/SKILL** Services/repairs the clutch of tractors and traction units needed for agricultural operations.

17.7 **TASK:** Replaces clutch damper.

PERFORMANCE OBJECTIVE:

CONDITIONS: Using the manufacturer's service manual, necessary parts and equipment, mechanic's tool set,

EVALUATION: replace clutch damper on designated tractor.

STANDARD: The cooling system should show no signs of leakage. The accessory drive and fan belt will be adjusted, and damper clutch willoperate according to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper shop safety procedures.
2. Drain cooling system.
3. Remove necessary sheet metal to reach radiator and engine.
4. Remove radiator - refer to competency 10.7 remove and replace radiator.
5. Loosen fan belt and remove any accessory drive.
6. Use puller to remove damper.
7. Inspect, remove and replace any worn or damaged parts.
8. Clean area, inspect oil seal in cover (install new seal even if just for preventive maintenance).
9. Coat timing case cover oil seal with light oil, inspect hub for seal wear.
10. Position damper on crankshaft, aligning keyway, and tap lightly into position.
11. Pull damper into position with damper retaining bolt and washer.
12. Torque to specifications.
13. Replace any accessory drive and fan belt.
14. Adjust drive belts.
15. Replace radiator.
16. Reconnect hoses.

17. Fill with collant and check for leakage.

18. Complete reassembly.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study the section on clutches in the manufacturer's service manual.

2. Replace clutch damper on designated tractor using service manual.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, necessary parts and equipment, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

17.0 **COMPETENCY/SKILL** Services/repairs the clutch of tractors and traction units needed for agricultural operations.

17.8 **TASK:** Rebuilds clutch.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the service manual, solvent, lubricants, replacement parts and equipment, mechanic's tool set,

EVALUATION: rebuild clutch on designated tractor.

STANDARD: Disassembly and reassembly must be in the order specified by the manufacturer. All worn or damaged parts must be repaired or replaced and the rebuilt clutch must operate as specified.

STUDENT LEARNING EXPERIENCES:

1. Discuss the proper shop safety procedure.
2. Discuss the centrifugal and mechanical type clutch.
3. Determine clutch type and specification by reading the manufacturer's service manual.
4. Disassemble clutch, remove all worn or damaged parts, following instructions in the service manual.
5. Demonstrate how to clean, replace and lubricate all parts with the recommended lubricants.
6. Reassemble to manufacturer's specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Make a list of things to watch for when servicing clutches.
2. Read the section on clutches for the designated tractor in the appropriate shop manual or the manufacturer's service manual.
3. Rebuild clutch on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, solvent, lubricants, replacement parts and equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.1 **TASK:** Replaces hydrostatic motor seals.

PERFORMANCE OBJECTIVE:

See Task 18.2.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.2 **TASK:** Rebuilds hydrostatic motor.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the manufacturer's service manual, steam cleaning equipment, clean and grease-free tools and supplies, clean working area, replacement parts, and oil,

EVALUATION: service a hydrostatic drive pump and motor.

STANDARD: All parts must be disassembled and reassembled according to manufacturer's specifications. Working area and all parts should be clean and no dirt, lint, or chaff should enter the system. The system must operate to manufacturer's specifications and no leakage should occur.

STUDENT LEARNING EXPERIENCES:

1. Discuss how to keep working area clean at all times and how to seal openings during servicing to keep dirt from entering system.

2. Demonstrate how to follow service manual procedures for testing the system and locating problem areas.

3. Demonstrate how to disassemble according to directions in the service manual.

4. Discuss how to clean, inspect, and replace worn or damaged parts.

5. Demonstrate how to reassemble according to directions in the service manual. Install new O-rings, seals, and gasket to seal mating parts and prevent leakage.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on hydrostatic drive pump and motor for the designated tractor in either the manufacturer's service manual or the appropriate shop manual.

2. Service the designated hydrostatic drive system.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, steam cleaning equipment, clean and grease-free tools, replacement parts, oil, and tractor.

RESOURCES:

FUNDAMENTALS OF SERVICE: POWER TRAINS. John Deere and Company, Moline, IL. Chapter 5. 1969.

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.3 **TASK:** Replaces hydrostatic motor.

PERFORMANCE OBJECTIVE:

See Task 18.2.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.4 **TASK:** Replaces air cooler.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, necessary tools and equipment, and replacement parts,

EVALUATION: replace air cooler.

STANDARD: There must be no damage to the system. The system must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss safety precautions to use when servicing/repairing agricultural power equipment and machinery.
2. Remove lines and install caps to cover fluid ports.
3. Remove and replace air cooler.
4. Remove caps and reconnect lines.
5. Check system for leaks and operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Replace air cooler on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts and equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.5 **TASK:** Replaces pump input shaft.

PERFORMANCE OBJECTIVE:

See Task 18.6.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.6 **TASK:** Rebuilds pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, a clean working area, mechanic's tool set, replacement parts, solvents and replacement fluid,

EVALUATION: rebuild pump.

STANDARD: There will be no damage to parts. All parts will be clean and correctly reassembled, in good working order. The pump will operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate safety precautions used when servicing/repairing agricultural power equipment and machinery.
2. Follow instructions in service manual to disconnect and disassemble pump.
3. Clean and inspect the spur gear, internal gear, drive shaft, separator, inlet and outlet openings, and housing. (If pump is a rotor model, clean and inspect all parts.)
4. Replace worn and/or damaged parts.
5. Reassemble following instructions in the service manual, replacing seals.
6. Operte pump and adjust if needed.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following demonstration, have students rebuild pump on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, solvents and replacement fluids, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.7 **TASK:** Replaces pump.

PERFORMANCE OBJECTIVE:

See Task 18.6.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.8 **TASK:** Replaces U-joint.

PERFORMANCE OBJECTIVE:

See Task 18.9.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.9 **TASK:** Rebuilds U-joints.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given new parts as needed, lubricant, service manual, mechanic's tool set,

EVALUATION: rebuild U-joints on designated tractor.

STANDARD: There will be no damage to any parts, new bearings and seals will be installed, and there will be no roughness or binding in the new bearings and seals.

STUDENT LEARNING EXPERIENCES:

1. Note position of grease fittings (if used) and mark the yoke in relation to the propeller shaft for reassembly purpose later.
2. Remove retainer plates (or snap rings) that hold bearings in yoke and drive shaft.
3. Place universal joint in a vise. Select a wrench socket with an outside diameter and slightly smaller than universal joint bearings, and select another wrench socket with an inside diameter slightly larger than the universal joint bearings. Place sockets at opposite bearings in the yoke so that the smaller socket becomes a bearing pusher and the larger becomes a bearing receiver.
4. Close vise jaws until both bearings are free of the yoke, and remove bearings from the cross or spider. (A hydraulic press may also be used.)
5. Check service manual for detailed instructions if bearings will not come all the way out.
6. Remove yoke from drive shaft and press bearings out of the drive shaft.
7. Clean and examine all parts, replacing parts with damage or excessive wear. (If old parts are to be reassembled, pack bearing cups with universal joint grease. If new parts are being installed, check new bearings for adequate grease.) Use new seals.
8. With pusher socket, press one bearing part way into drive shaft. Position spider into partially installed bearing and place second bearing into drive shaft.
9. Put drive shaft in vise so that bearings are in contact with faces of vise jaws.

10. Press bearings into position and install snap rings on retainer plates.

11. Install bearings in yoke in same manner. Check universal joints for roughness and binding, and correct the condition if necessary prior to installation in tractor.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Answer the following questions:

   A. What does a universal joint do?
   B. What is the most common type of universal joint?
   C. List the parts that make up a universal joint and be able to identify them.

2. Using the manufacturer's service manual, service or rebuild a universal joint on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, lubricants, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.10 **TASK:** Rebuilds top shaft.

PERFORMANCE OBJECTIVE:

See Task 18.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.11 **TASK:** Replaces top shaft gears.

PERFORMANCE OBJECTIVE:

See Task 18.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.12 **TASK:** Replaces bottom shaft gears.

PERFORMANCE OBJECTIVE:

See Task 18.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.13 **TASK:** Replaces shaft collars.

PERFORMANCE OBJECTIVE:

See Task 18.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.14 **TASK:** Replaces shaft bearings.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the necessary tools, equipment, supplies and manufacturer's service manual,

EVALUATION: replace shaft bearings on designated tractor.

STANDARD: All parts will be clean and reassembled correctly with no damage to any parts. They will be properly torqued, lubricated and functioning to manufacturer's specifications. Disassembly and reassembly will be performed in the order outlined by the manufacturer and according to specifications.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate safety precautions to use when servicing/repairing a tractor transmission.

2. Remove transmission from tractor according to directions in servicing manual for specific tractor.

3. Remove bolts and lift covers from case.

4. Remove shifter fork spring and detent ball.

5. Disconnect clutch release bearing springs and remove bearing and hub assembly.

6. Remove bolts and lock washers that attach clutch release bearing support assembly to transmission case.

7. Remove input shaft and support assembly as a unit.

8. Loosen lock nut on lock screw in first and third gear shifter fork. Slide shifter rail out of transmission case.

9. Remove shifter fork from its position in outlet shaft connector coupling. Remove the shifter plate pivots and gaskets from each side of housing. Lift plates out of case.

10. Remove bolts and lock wahers that hold output shaft bearing retainer on the case. Remove retainer. (Keep shims for reassembly.)

11. Take output shaft gear assembly from case (provide clearance, if necessary by pushing reverse gear shifter fork and second and fourth gear shifter fork forward.)

12. Remove shifter rail spring seat, gasket, spring, detent ball from right side of transmission case. Loosen lock nut on lock screw in second and fourth gear shifter fork and back off screw.

13. Remove shifter rail cap plug from rear of transmission case. Pull shifter rail out of case. Remove shifter fork from counter-shaft connector coupling.

14. Remove bolts and lock washers that hold support and shifter assembly on rear of transmission case. Remove assembly, keeping shims together for reassembly.

15. Remove countershaft assembly, reverse shifter rail spring seat, gasket, spring and detent ball from left side of transmission case.

16. Loosen lock nut on lock screw in reverse gear shift fork. Back off lock screw.

17. Remove shifter rail cap plug from rear of transmission case and pull reverse gear-shift rail out of housing.

18. Remove shifter fork from reverse idle driver gear.

19. Pull reverse idler shaft from its bore in case. Remove gears and thrust washer from transmission. Remove snap ring and O-ring from reverse idle shaft.

20. Clean all parts in suitable solvent. (To clean bearings, rotate in solvent and dry carefully with compressed air. Do not spin.)

21. Inspect all parts for wear or damage. Discard and replace all defective parts including case if necessary.

22. Lubricate parts. Install new oil seals and gaskets.

NOTE: TO DISASSEMBLE AND ASSEMBLE OUTPUT SHAFT:

-Remove rear bearing cup and oil seal from retainer.
-Remove fourth gear, thrust washer and front bearing.
-Remove second gear from shaft. Remove first gear, thrust washer, rear bearing, oil seal sleeve.
-Remove coupling, connector, and third gear from output shaft.
-Press output shaft front bearing on output shaft.
-Place third gear, first, and third gear connector and coupling, and first gear and thrust washer on rear of shaft.
-Press the rear bearing and oil sleeve on the output shaft.

TO DISASSEMBLE AND ASSEMBLE COUNTERSHAFT:

-Remove countershaft front bearing cup from transmission housing.
-Pull countershaft fourth gear, second, and fourth connector and coupling off. Slide countershaft second gear off.
-Inspect, repair, or replace parts.
-Install front bearing cup in transmission housing.
-Install in order on countershaft: second gear, second and fourth gear connector and coupling, countershaft fourth and drive gear. Press on countershaft front bearing and oil seal sleeve.

23. Check output shaft preload with a cord and pull scale. (Preload should be checked when; lower gear forks are in neutral, top gear forks are not yet installed, and the gears and bearings are lightly oiled.) Add or remove shims as required to provide specified preload. Remove output shaft from transmission case and begin complete reassembly. Lubricate all gears and bearings before installing in case. Install new O-ring and snap ring on reverse idler shaft.

24. Reassemble all parts according to manufacturer's service manual until constant mesh transmissionisin working order.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the disassembly and reassembly procedures for the transmission in the manufacturer's service manual.
2. Following a demonstration, have students replace shaft bearings on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, lubricant, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.15 **TASK:** Adjusts shifting linkage.

PERFORMANCE OBJECTIVE:

See Task 18.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.16 **TASK:** Rebuilds shaft quadrant.

PERFORMANCE OBJECTIVE:

See Task 18.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.17 **TASK:** Replaces shift cable.

PERFORMANCE OBJECTIVE:

See Task 18.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.18 **TASK:** Replaces shift retainer.

PERFORMANCE OBJECTIVE:

See Task 18.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.19 **TASK:** Replaces shifters.

PERFORMANCE OBJECTIVE:

See Task 18.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.20 **TASK:** Replaces shifting shaft.

PERFORMANCE OBJECTIVE:

See Task 18.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.21 **TASK:** Rebuilds two-speed pack.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the manufacturer's service manual, solvents, oil, replacement parts, mechanic's tool set and equipment,

EVALUATION: service a two-speed pack.

STANDARD: Disassembly and reassembly of parts must meet specifications given in service manual. All excessively worn or defective parts should be replaced.

STUDENT LEARNING EXPERIENCES:

1. Discuss safety precautions used when servicing/repairing agricultural power equipment and machinery.
2. Demonstrate how to remove two-speed pack from tractor according to instructions in service manual for specific tractor.
3. Discuss how to clean parts and make oil change.
4. Replace worn or damaged parts.
5. Reassemble two-speed pack.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study the section on disassembly of a two-speed pack in the appropriate shop manual or manufacturer's service manual for the designated tractor.
2. Following a demonstration, have students re-build two-speed pack on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, solvents, oil, replacement parts, necessary equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.22 **TASK:** Replaces front wheel drive U-joints.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the manufacturer's service manual, replacement parts, necessary tools and equipment,

EVALUATION: replace front wheel drive U-joints.

STANDARD: Disassembly and reassembly of parts must meet specifications given in service manual. All excessively worn or defective parts should be replaced.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate shop safety precautions.
2. Demonstrate how to remove front wheel drive U-joints from tractor according to directions in service manual for specific tractor.
3. Install new replacement parts in accordance with manufacturer's specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study the section on disassembly of front wheel drive U-joints in the appropriate shop manual or manufacturer's service manual for designated tractor.
2. Following a demonstration, have students replace front wheel drive U-joints on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, solvents, oil, replacement parts, necessary equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.23 **TASK:** Replaces front wheel drift shaft.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, replacement parts, necessary tools and equipment,

EVALUATION: replace front wheel drift shaft.

STANDARD: Disassembly and reassembly of parts must meet specifications given in service manual.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate shop safety precautions.
2. Demonstrate how to remove front wheel drift shaft from tractor according to directions in service manual.
3. Install replacement parts in accordance with manufacturer's specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study the section on disassembly of front wheel drift shaft in the appropriate shop manual or manufacturer's service manual for the designated tractor.
2. Following a demonstration, have students replace front wheel drift shaft on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, necessary equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.24 **TASK:** Replaces drive line U-joints.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given new parts as needed, lubricant, a manufacturer's service manual, and the necessary tools,

EVALUATION: service a universal joint.

STANDARD: The universal joint should move freely and without noise. There should be no damage to any parts, new bearings and seals must be installed, and there must be no roughness or binding in the new bearings and seals.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspect of servicing a universal joint.
2. Identify the causes of the need to service a universal joint.
3. List the steps in troubleshooting a universal joint.
4. Discuss the procedures as outlined in service manual for servicing a universal joint.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Troubleshoot a universal joint.
2. Service a universal joint.

   NOTE: The three common types of universal joints are (1) cross and roller, (2) ball and trunnion, and (3) constant velocity. There are several variations on each type. Check manufacturer's service manual for specific details.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, lubricant, replacement parts, necessary tools and equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.25 **TASK:** Replaces reduction gear bearing retainer.

PERFORMANCE OBJECTIVE:

See Task 20.5.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.26 **TASK:** Cleans oil sump strainer.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the manufacturer's service manual, necessary tools, clean rags and solvent, and recommended hydraulic oil,

EVALUATION: clean oil sump strainer.

STANDARD: There must be no damage to the system and flushing should continue until the system is clean. The recommended oil must be used.

STUDENT LEARNING EXPERIENCES:

1. Discuss safety precautions to use when servicing/repairing agricultural power equipment and machinery.
2. Demonstrate how to drain fluid.
3. Remove inspection plate.
4. Remove sludge from bottom of reservoir.
5. Clean oil sump strainer with solvent.
6. Rinse reservoir with solvent.
7. Flush until system is clean.
8. Refill the system with clean hydraulic oil of the recommended type.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Clean oil sump stainer on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, clean rags and solvent, recommended hydraulic oil, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.27 **TASK:** Replaces hydrostat reservoir.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the manufacturer's service manual, necessary tools, replacement parts, recommended bydraulic oil, and clean rags,

EVALUATION: replace hydrostat reservoir.

STANDARD: The replaced hydrostat reservoir must be installed in accordance with manufacturer's specifications. There must be no damage to the system.

STUDENT LEARNING EXPERIENCES:

1. Discuss safety precautions to use when servicing/repairing agricultural power equipment and machinery.
2. Explain why most chemical cleaners and solvents are not recommended for flushing hydraulic systems.
3. Discuss how to drain the system, as recommended in the service manual.
4. Discuss how to clean or remove the filter elements.
5. Demonstrate how to flush out the old oil remaining in the system, using recommended hydraulic fluid.
6. Demostrate how to remove and replace hydrostat reservoir.
7. Demonstrate how to introduce specified amount of flushing oil and how to operate the equipment to cycle the flushing oil through the system.
8. Demonstrate how to run the oil through the system until satisfactorily cleaned.
9. Explain how to drain out flushing oil and reinstall the system filters.
10. Discuss how to refill the system with clean hydraulic oil of the recommended type.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Replace hydrostat reservoir on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, hydraulic oil, clean rags, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.28 **TASK:** Replaces hydrostat fluid/filter.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the new filters recommended in the manufacturer's service manual, the necessary tools, new parts and clean oil,

EVALUATION: change the hydrostat oil filters.

STANDARD: The new filters will be the type recommended in the service manual. The system must operate to specifications.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate safety precautions used when servicing/repairing agricultural power equipment and machinery.
2. Read manufacturer's service manual to determine location of filters.
3. Remove all parts necessary to reach and remove old filters.
4. Install the filters recommended by the manufacturer.
5. Add oil to correct level.
6. Reassemble and reinstall all parts removed.
7. Check operation of hydrostat system and check for leaks.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Change hydrostat fluid/filter on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, new filters and parts, clean oil, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

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18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.29 **TASK:** Replaces gaskets.

PERFORMANCE OBJECTIVE:

See Task 18.2.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.30 **TASK:** Replaces hydrostatic drive belts.

PERFORMANCE OBJECTIVE:

See Task 18.2.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.31 **TASK:** Installs planetary drive shaft seal.

PERFORMANCE OBJECTIVE:

See Task 20.5.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

18.0 **COMPETENCY/SKILL:** Services/repairs transmission of tractors and traction units needed for agricultural operations.

18.32 **TASK:** Replaces transmission case.

PERFORMANCE OBJECTIVE:

See Task 18.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

19.0 **COMPETENCY/SKILL:** Services/repairs the differential on tractors and traction units needed for agricultural operations.

19.1 **TASK:** Sets bearings preload.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a designated tractor and the service manual, a set of spacers, and all necessary tools,

EVALUATION: preload the bearings on the axle shaft.

STANDARD: The correct spacer as outlined in the service manual will be used, the dial indicator reading will be the same as the instructor's, and all parts will be reassembled according to manufacturer's instructions with no parts damaged.

STUDENT LEARNING EXPERIENCES:

1. Follow manufacturer's instructions in the service manual to reach axle shaft bearings.
2. Using a .089 inch (2.261 mm) spacer, fit spacer, retaining washer and tighten the axle shaft bolt (s).
3. Set up a dial indicator with an extended plunger on top of the axle shaft bolt (s).
4. Set the dial indicator at zero and lift the axle housing. (This action will result in a dial indicator reading which shows the free movement between the inner and outer cone and roller assembly and their cups.)
5. To determine correct bearing preload, the reading obtained is subtracted from the spacer size fitted (i.e., .089 inch or 2.261 mm).
6. Check manufacturer's specifications and select and install the correct spacer.
7. Reassemble parts following the manufacturer's instructions in the service manual.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Answer the following questions:

   A. What does it mean to "Preload Bearings?"

   B. Preloading is normally measured in inch - pounds of starting torque (True - False). Why?

   C. What are two methods of measuring rolling torque?

   D. What will happen if the bearings are not installed correctly?

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, a set of spacers, dial indicator, necessary tools and equipment, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

19.0 **COMPETENCY/SKILL:** Services/repairs the differential on tractors and traction units needed for agricultural operations.

19.2 **TASK:** Replaces bearings.

PERFORMANCE OBJECTIVE:

See Task 19.13.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

19.0 **COMPETENCY/SKILL:** Services/repairs the differential on tractors and traction units needed for agricultural operations.

19.3 **TASK:** Replaces ring gear.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual for the tractor being used, mechanic's tool set, and dial indicator,

EVALUATION: correct the adjustment of the ring gear and pinion on the differentials.

STANDARD: The adjustments will be to manufacturer's specifications, all parts will be assembled and installed according to manufacturer's directions, and there will be no damage to any parts.

STUDENT LEARNING EXPERIENCES:

1. Following the instructions in the service manual for the tractor in question, remove parts necessary to give access to ring gear and pinion.
2. Using a dial indicator, check the ring gear backlash at several locations on the ring gear.
3. Check readings against manufacturer's specifications, and adjust ring gear and pinion to manufacturer's specifications as shown in the service manual.
4. Reassemble and/or reinstall all parts.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on ring gear and pinion in the manufacturer's service manual.

2. Complete the following:

   A. What are the three kinds of adjustments that need to be made on the gear train? Explain the importance of adjustments.

   B. Once the gear set is assembled, what are the four steps needed to adjust it?

3. Label the parts of a ring gear and pinion on the diagram provided by the instructor.

4. Correct the adjustment of the ring gear and pinion on the designated tractor using Student learning Tasks, MANUAL, and the manufacturer's service manual.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, dial indicator, necessary parts and equipment, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

19.0 **COMPETENCY/SKILL:** Services/repairs the differential on tractors and traction units needed for agricultural operations.

19.4 **TASK:** Replaces pinon shaft.

PERFORMANCE OBJECTIVE:

See Task 19.13.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

19.0 **COMPETENCY/SKILL:** Services/repairs the differential on tractors and traction units needed for agricultural operations.

19.5 **TASK:** Replaces housing.

PERFORMANCE OBJECTIVE:

See Task 19.13.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

19.0 **COMPETENCY/SKILL:** Services/repairs the differential on tractors and traction units needed for agricultural operations.

19.6 **TASK:** Replaces lock.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a designated tractor and service manual, necessary tools, supplies, and replacement parts,

EVALUATION: service the differential locks (mchanical and hydraulic).

STANDARD: All worn or damaged parts must be repaired or replaced according to manufacturer's specifications, and all parts must be clean upon visual inspection. The differential and differential locks must be disassembled and reassembled in the order specified in the service manual.

STUDENT LEARNING EXPERIENCES:

1. Discuss the function of a differential lock.
2. List three types of differential locks.
3. Describe how each of the three types of differential locks works and how each differs from the others.
4. Demonstrate how to follow prescribed procedural steps to service mechanical and hydraulic differential locks.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on differentials in the appropriate shop manual or manufacturer's service manual.
2. Service the differential locks on the assigned tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, necessary tools, supplies, equipment, replacement parts, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

19.0 **COMPETENCY/SKILL:** Services/repairs the differential on tractors and traction units needed for agricultural operations.

19.7 **TASK:** Replaces disk.

PERFORMANCE OBJECTIVE:

See Task 19.13.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

310

19.0 **COMPETENCY/SKILL:** Services/repairs the differential on tractors and traction units needed for agricultural operations.

19.8 **TASK:** Replaces piston.

PERFORMANCE OBJECTIVE:

See Task 18.2.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

311

19.0 **COMPETENCY/SKILL:** Services/repairs the differential on tractors and traction units needed for agricultural operations.

19.9 **TASK:** Replaces lock plates.

PERFORMANCE OBJECTIVE:

CONDITIONS: Using a designated tractor and the service manual, necessary tools, supplies, and replacement parts,

EVALUATION: service the differential locks (mechanical and hydraulic).

STANDARD: All worn or damaged parts will be repaired or replaced according to manufacturer's specifications. All parts will be clean on visual inspection. The differential and differential locks will be disassembled and reassembled in the order specified in the service manual.

STUDENT LEARNING EXPERIENCES:

Refer to manufacturer's service manual to overhaul differential lock assembly:

1. Remove left hand wheel and fender.
2. Disconnect electrical wiring and brake linkage to gain access to rear axle.
3. Drain oil from rear axle center housing.
4. Disassemble according to instructions in service manual.
5. Inspect and clean all parts.
6. Repair or replace parts where necessary following instructions in the service manual.
7. Assemble all parts.
8. Replace oil in rear axle center housing.
9. Connect electrical wiring and brake linkage.
10. Replace wheel and fender.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on differentials in the I & T SHOP MANUAL or manufacturer's service manual.

2. Complete the following questions:

   A. What is the function of a differential lock?
   B. What are three types of differential locks?
   C. Briefly describe how each of them work and how they differ from one another.
   D. Which type of differential does not allow the inside wheel on a turn to slow down-only the outside wheel to speed up?

3. With the help of the Student Learning Tasks and service manual, service the differential locks on the assigned tractors.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, necessary tools, supplies, replacement parts, equipment, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

19.0 **COMPETENCY/SKILL:** Services/repairs the differential on tractors and traction units needed for agricultural operations.

19.10 **TASK:** Sets backlock.

PERFORMANCE OBJECTIVE:

See Task 19.9.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

314

19.0 **COMPETENCY/SKILL:** Services/repairs the differential on tractors and traction units needed for agricultural operations.

19.11 **TASK:** Changes thrust washers.

PERFORMANCE OBJECTIVE:

See Task 19.13.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

315

19.0 **COMPETENCY/SKILL:** Services/repairs the differential on tractors and traction units needed for agricultural operations.

19.12 **TASK:** Replaces quill.

PERFORMANCE OBJECTIVE:

See Task 19.13.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

19.0 COMPETENCY/SKILL: Services/repairs the differential on tractors and traction units needed for agricultural operations.

19.13 TASK: Replaces differential.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, necessary tools and equipment, and replacement parts,

EVALUATION: repair the differential.

STANDARD: Disassembly and reassembly will be in the order specified in the service manual. All parts will be clean and lubricated when specified. All parts will be torqued to specifications.

STUDENT LEARNING EXPERIENCES:

To repair differentials on a tractor you must have the service manual for the make and model of the tractor. The following instructions are for an Allis-Chambers tractor.

1. Draw the oil from the transmission, differential and final drive compartments.

2. Support transmission housing to permit removal of rear wheels.

3. Remove:

   A. seat
   B. hydraulic control valve
   C. transmission cover from top of differential and final drive compartments.
   D. rear power take-off shaft and lift housing
   E. rear wheels and rear axle
   F. brake assemblies
   G. final drive pinion shafts
   H. differential bearing carriers at both sides of housing (keep shims in the same order and with correct carrier to make reassembly easier)
   I. differential assembly from top of housing
   J. lock pin retaining the pinion shaft (drive lock pin out by inserting punch through ring gear side of assembly)
   K. side pinion and thrust washers
   L. the two side gears and thrust washers.

4. Pull bearing cones from differential case if replacement is needed.

5. Pull bearing cups from bearing carriers if replacement is needed.

6. Remove oil seals from bearing carriers.

7. The rivet retaining ring gear will have to be cut and driven out if the ring gear of differential case is to be replaced.

8. Check all parts for wear and replace parts where necessary.

9. Check manufacturer's service manual for differential installation for specific model.

10. Install:

    A. ring gear to differential case with bolt set 236962
    B. bolts through ring gear with nuts on outer side of mounting flange.
    C. both side gears and thrust washers through opeing in differential case
    D. pinion gears and thrust washers spacing them equal at each side of case, rolling them around until they are in line with the pinion shaft bore in differential case.
    E. pinion shaft with hole at end of shaft in line with lock pin hole in case.
    F. lock pin (peen edge of hole to retain pin)
    G. bearing cones at each side of differential case (larger diameter of bearing toward case)
    H. bearing cups in bearing carries (larger inside diameter of cup inward)
    I. oil seals in bearing carriers (lip of seal toward differential assembly)
    J. differential assembly into transmission housing with rear gear on right hand side
    K. bearing carriers to transmission housing (use shims that were removed with each carrier)

11. Use No. 3 permatex on pilot area of the bearing area carriers and on threads of retaining cap screws.

12. Tighten retaining cap screws 45-50 ft. lbs torque.

13. Reassemble remaining parts in the reverse order removed, checking service manual for specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Complete the following questions:

   A. What are two jobs that a differential does?
   B. What is normally adjusted in the differential?
   C. What are 4 common failures of differentials and the possible causes?

2. With the help of the service manual, repair the differentials on the designated tractors.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, necessary tools, equipment, replacement parts, solvents, lubricants, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

20.0 **COMPETENCY/SKILL:** Services/repairs the final drive on tractors and traction units needed for agricultural operations.

20.1 **TASK:** Replaces seals/bearings.

PERFORMANCE OBJECTIVE:

See Task 20.9 - Replace axle.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

320

20.0 **COMPETENCY/SKILL:** Services/repairs the final drive on tractors and traction units needed for agricultural operations.

20.2 **TASK:** Rebuilds housing.

PERFORMANCE OBJECTIVE:

See Task 20.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

20.0 **COMPETENCY/SKILL:** Services/repairs the final drive on tractors and traction units needed for agricultural operations.

20.3 **TASK:** Replaces housing.

PERFORMANCE OBJECTIVE:

See Task 20.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

20.0 **COMPETENCY/SKILL:** Services/repairs the final drive on tractors and traction units needed for agricultural operations.

20.4 **TASK:** Replaces carrier.

PERFORMANCE OBJECTIVE:

See Task 19.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

20.0 **COMPETENCY/SKILL:** Services/repairs the final drive on tractors and traction units needed for agricultural operations.

20.5 **TASK:** Reconditions planetary pack.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, needed parts, tools, and equipment,

EVALUATION: service inboard and outboard planetary drives.

STANDARD: All parts must be thoroughly cleaned, disassembly and reassembly should be in order specified by manufacturer's instructions, and there should be no damage to any part.

STUDENT LEARNING EXPERIENCES:

1. Explain the difference between the planetary gear reduction system and the pinion type.
2. Discuss the durability of planetary systems.
3. Explain the function of the final drive shaft.
4. Describe how both the inboard and outboard planetary drives work.
5. Cite three basic parts of planetary drive system.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Identify a tractor with an inboard planetary drive and one with an outboard planetary drive.
2. Read the section of final drives in the appropriate shop manual or the manufacturer's service manual.
3. Service the inboard and outboard mounted planetary drives on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts, tools, equipment, solvent, lubricants, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

20.0 **COMPETENCY/SKILL:** Services/repairs the final drive on tractors and traction units needed for agricultural operations.

20.6 **TASK:** Replaces gaskets.

PERFORMANCE OBJECTIVE:

CONDITIONS: Using a designated tractor and the manufacturer's service manual, new gaskets and seals, necessary tools, equipment, and supplies,

EVALUATION: replace the brake and axle seals and gaskets.

STANDARD: All seals will meet specifications, be correctly installed, and show no signs of leaks. All parts will be reassembled to manufacturer's instructions and specifications, and there will be no damage to any parts.

STUDENT LEARNING EXPERIENCES:

1. Follow instructions in manufacturer's service manual to reach seals and gaskets.
2. Remove old seals and gaskets.
3. Clean seal and gasket seats thoroughly without removing any metal.
4. Install new seals and gaskets making sure each is properly seated.
5. Reassemble according to manufacturer's instructions and specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. With the help of the Student Learning Tasks, replace the brake and axle seals and gaskets on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, new gaskets and seals, necessary tools, equipment, solvents, lubricants, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASIC EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

20.0 **COMPETENCY/SKILL:** Services/repairs the final drive on tractors and traction units needed for agricultural operations.

20.7 **TASK:** Sets torque on axle nuts.

PERFORMANCE OBJECTIVE:

See Task 20.8.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

20.0 **COMPETENCY/SKILL:** Services/repairs the final drive on tractors and traction units needed for agricultural operations.

20.8 **TASK:** Replaces axle.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the manufacturer's service manual, needed tools and replacement parts,

EVALUATION: replace axle on designated tractor.

STANDARD: All parts will be throughly cleaned. Disassembly and reassembly will be in order of manufacturer's instructions. There will be no damage to any part.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate safety precautions used when servicing/repairing the final drive.
2. Refer to manufacturer's service manual for make, model, and year of tractor for disassembly instructions.
3. Disassemble rear axle shaft assembly following steps outlined in service manual.
4. Disassemble planetary drive.
5. Thoroughly clean and inspect all parts and replace parts which are worn or damaged. If necessary, install new inner bearing cup. If necessary, install new planetary ring. If necessary, replace seals and bearings.
6. Reassemble planetary drive following steps outlined in service manual.
7. Install new axle shaft assembly according to manufacturer's specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on final drives in manufacturer's service manual prior to servicing/repairing an axle.

2. Following a demonstration, have students replace axle on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed tools, equipment, replacement parts, solvent, lubricants, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

20.0 **COMPETENCY/SKILL:** Services/repairs the final drive on tractors and traction units needed for agricultural operations.

20.9 **TASK:** Replaces output-input shaft.

PERFORMANCE OBJECTIVE:

See Task 20.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

20.0 **COMPETENCY/SKILL:** Services/repairs the final drive on tractors and traction units needed for agricultural operations.

20.10 **TASK:** Replaces couplers.

PERFORMANCE OBJECTIVE:

See Task 18.2.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

330

20.0 **COMPETENCY/SKILL:** Services/repairs the final drive on tractors and traction units needed for agricultural operations.

20.11 **TASK:** Adds oil.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the wrench to fit the type of plug head and proper lubricant,

EVALUATION: check the transmission and/or differential lubricant level on a plug equipped tractor.

STANDARD: The transmission and/or differential will have the proper oil level as specified in service manual. The plug will be tight when the operation is complete.

STUDENT LEARNING EXPERIENCES:

1. On a plug equipped tractor:

   A. Remove level check plug.
   B. Add lubricant until the lubricant overflows from the check plug hole.
   C. Replace plug. (If oil flows out when plug is removed, no additonal oil is necessary.)

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Complete the following questions:

   A. How often should you check the transmission and/or differential lubricant levels?

   B. Describe how you can check the lubricant level if your machine doesn't have a dipstick.

2. Check the transmission and/or different lubricant level on a designated tractor equipped with a plug.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, lubricant, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

20.0 **COMPETENCY/SKILL:** Services/repairs the final drive on tractors and traction units needed for agricultural operations.

20.12 **TASK:** Replaces spacer.

PERFORMANCE OBJECTIVE:

CONDITIONS: Using a designated tractor and service manual, a set of spacers, necessary tools and equipment,

EVALUATION: preload the bearings on the axle shaft.

STANDARD: The correct spacer as outline in the service manual will be used, the dial indicator reading will be the same as the instructor's, and all parts will be reassembled according to manufacturer's instructions with no parts damaged.

STUDENT LEARNING EXPERIENCES:

1. Follow manufacturer's instruction in the service manual to reach axle shaft bearings.
2. Using a .089 in. (2.261 mm) spacer, fit spacer, retaining washer and tighten the axle shaft bolt(s).
3. Set up a dial indicator with and extended plunger on top of the axle shaft bolt(s).
4. Set the dial indicator at zero and lift the axle housing. (This action will result in a dial indicator reading which shows the free movement between the inner and outer cone and roller assembly and their cups.)
5. To determine correct bearing preload, the reading obtained is subtracted from the spacer size fitted (i.e., .089 or 2.261 mm).
6. Check manufacturer's specifications and select and install the correct spacer.
7. Reassemble all parts following the manufacturer's instructions in the service manual.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on axle bearings in the I & T SHOP MANUAL or manufacturer's service manual before preloading the axle bearing.

2. With the help of the Student Learning Experiences or the manufacturer's service manual, preload the bearings on the axle of the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, a set of spacers, mechanic's tool set, dial indicator, necessary tools, equipment, and tractor.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

20.0 **COMPETENCY/SKILL:** Services/repairs the final drive on tractors and traction units needed for agricultural operations.

20.13 **TASK:** Replaces bearing cup and cone.

PERFORMANCE OBJECTIVE:

See Task 20.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

20.0 **COMPETENCY/SKILL:** Services/repairs the final drive on tractors and traction units needed for agricultural operations.

20.14 **TASK:** Services/rebuilds final drive.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a designated tractor and service manual, proper tools, cleaning solution, lubricants and repalcement parts,

EVALUATION: Service/repair the final drive on designated tractor.

STANDARD: All parts must be clean and lubricated. Disassembly and reassembly must follow manufacturer's recommendations. All parts must be torqued according to manufacturer's specifications, and there should be no damage to any parts.

STUDENT LEARNING EXPERIENCES:

1. Discuss three major types (pinion, planetary, and chain) of final drives.

2. Explain the two types of pinion and gear reductions:

   A. A pinion drive located in the differential case.
   B. A pinion drive located on the outer ends of final drives.

3. Discuss what makes the two types of pinion and gear reductions different.

4. Discuss three key points to remember when diagnosing final drive failures.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on final drives in the appropriate shop manual or the manufacturer's service manual for the designated tractor.

2. Service the final drive on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, cleaning solution, lubricants, necessary tools, equipment, replacement parts, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

21.0 **COMPETENCY/SKILL:** Services/repairs the PTO on tractors and traction units needed for agricultural operations.

21.1 **TASK:** Replaces shaft.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a replacement shaft, necessary tools and equipment,

EVALUATION: replace the PTO shaft.

STANDARD: The replaced power take-off shaft must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing power take-off drive.
2. Identify the causes of the need to service power take-off drive.
3. Demonstrate how to remove damaged PTO shaft.
4. Demonstrate how to install new PTO shaft.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Troubleshoot a power take-off drive.
2. Following a demonstration, have student replace the PTO shaft on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement PTO shaft, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

21.0 **COMPETENCY/SKILL:** Services/repairs the PTO on tractors and traction units needed for agricultural operations.

21.2 **TASK:** Replaces bearings.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, replacement parts and equipment,

EVALUATION: replace PTO drive bearings.

STANDARD: The repaired PTO drive must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing power take-off drive.
2. Identify the causes of the need to service power take-off drive.
3. Demonstrate how to remove worn or damaged bearings.
4. Demonstrate how to install new bearings in PTO drive.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Troubleshoot a power take-off drive.
2. Inspect PTO drive.
3. Following a demonstration, have students replace bearings in power take-off drive.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, solvents, lubricants, replacement parts, necessary tools and equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

21.0 **COMPETENCY/SKILL:** Services/repairs the PTO on tractors and traction units needed for agricultural operations.

21.3 **TASK:** Replaces disc.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a replacement disc, mechanic's tool set, necessary equipment and service manual,

EVALUATION: replace PTO drive disc.

STANDARD: The repaired PTO drive must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing power take-off drive.
2. Identify the causes of the need to service power take-off drive.
3. Demonstrate how to remove worn or damaged disc.
4. Demonstrate how to install new disc on PTO drive.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Troubleshoot a power take-off drive.
2. Inspect power take-off drive.
3. Following a demonstration, have students replace the power take-off drive disc.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement part, needed tools and equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

21.0 **COMPETENCY/SKILL:** Services/repairs the PTO on tractors and traction units needed for agricultural operations.

21.4 **TASK:** Replaces drive plates.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, replacement parts and equipment,

EVALUATION: replace drive plates.

STANDARD: The replaced drive plates must be installed to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing power take-off drive.
2. Identify the causes of the need to service power take-off drive.
3. Demonstrate how to remove worn or damaged drive plates.
4. Demonstrate how to install new drive plates in PTO drive.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Troubleshoot a power take-off drive.
2. Inspect PTO drive.
3. Following a demonstration, have students replace drive plates on designated PTO drive.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement part, needed tools and equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

21.0 **COMPETENCY/SKILL:** Services/repairs the PTO on tractors and traction units needed for agricultural operations.

21.5 **TASK:** Replaces oil lines.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given new oil lines, a service manual, mechanic's tool set, and necessary equipment,

EVALUATION: replace oil lines.

STANDARD: The replaced oil lines must be installed and operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing power take-off drive.
2. Identify the causes of the need to service power take-off drive.
3. Demonstrate how to remove worn or damaged oil lines.
4. Demonstrate how to install new oil lines on PTO drive.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Inspect power take-off drive.
2. Troubleshoot a power take-off drive.
3. Following a demonstration, have students replace oil lines on designated PTO drive.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, lubricants, necessary equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

21.0 **COMPETENCY/SKILL:** Services/repairs the PTO on tractors and traction units needed for agricultural operations.

21.6 **TASK:** Replaces seals.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given new seals, a service manual, mechanic's tool set, needed equipment,

EVALUATION: replace seal on designated tractor's PTO drive.

STANDARD: The seals must be installed so that there are no leaks and installation must be in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing power take-off drive.
2. Identify the causes of the need to service power take-off drive.
3. Demonstrate how to remove worn or damaged seals.
4. Demonstrate how to install new seals in PTO drive.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Troubleshoot a power take-off drive.
2. Inspect PTO drive.
3. Following a demonstration, have students replace seals on designated power take-off drive.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, lubricant, needed equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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21.0 **COMPETENCY/SKILL:** Services/repairs the PTO on tractors and traction units needed for agricultural operations.

21.7 **TASK:** Replaces gaskets.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given new gaskets, a service manual, mechanic's tool set, needed equipment,

EVALUATION: replace gaskets on the designated PTO drive.

STANDARD: The gaskets must be installed so that there are no leaks and installation must be in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing power take-off drive.
2. Identify the causes of the need to service power take-off drive.
3. Demonstrate how to remove worn or damaged gaskets.
4. Demonstrate how to install new gaskets in PTO drive.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Troubleshoot a power take-off drive.
2. Inspect take-off drive.
3. Following a demonstration, have students replace gaskets on designated power take-off drive.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, sealants, replacement parts, needed equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

21.0 **COMPETENCY/SKILL:** Services/repairs the PTO on tractors and traction units needed for agricultural operations.

21.8 **TASK:** Adjusts linkage.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given necessary tools and supplies, and a tractor with power take-off drive,

EVALUATION: adjust the power take-off drive linkage.

STANDARD: The adjusted power take-off drive linkage must be correct and operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing power take-off drive.
2. Identify the causes of the need to service power take-off drive.
3. List steps in troubleshooting power take-off drive.
4. Demonstrate how to adjust power take-off drive linkage.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Troubleshoot a power take-off drive.
2. Inspect take-off drive.
3. Observe the safety rules in servicing power take-off drive.
4. Following demonstration, have students adjust the power take-off drive linkage on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, solvent, lubricant, needed equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

21.0 **COMPETENCY/SKILL:** Services/repairs the PTO on tractors and traction units needed for agricultural operations.

21.9 **TASK:** Replaces quill assembly.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, necessary replacement parts and equipment,

EVALUATION: replace quill assembly on the designated PTO drive.

STANDARD: The replaced quill assembly must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing power take-off drive.
2. Identify the causes of the need to service power take-off drive.
3. Demonstrate how to remove worn or damaged quill assembly.
4. Demonstrate how to install a new quill assembly on PTO drive.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Troubleshoot a power take-off drive.
2. Inspect PTO drive.
3. Following demonstration, have students replace quill assembly on designated power take-off drive.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, solvent, lubricants, replacement parts, needed equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

21.0 **COMPETENCY/SKILL:** Services/repairs the PTO on tractors and traction units needed for agricultural operations.

21.10 **TASK:** Rebuilds brake.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, replacement parts and equipment,

EVALUATION: rebuild brake on the designated PTO drive.

STANDARD: The rebuilt brake must be installed and operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing power take-off drive.
2. Identify the causes of the need to service power take-off drive.
3. Demonstrate how to remove worn or damaged brake.
4. Demonstrate how to install a new or rebuilt brake on PTO drive.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Troubleshoot a power take-off drive.
2. Inspect PTO drive.
3. Following demonstration, have students rebuild the brake on designated power take-off drive.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts and supplies, needed equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

21.0 **COMPETENCY/SKILL:** Services/repairs the PTO on tractors and traction units needed for agricultural operations.

21.11 **TASK:** Replaces brake.

PERFORMANCE OBJECTIVE:

See Task 21.10.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

21.0 **COMPETENCY/SKILL:** Services/repairs the PTO on tractors and traction units needed for agricultural operations.

21.12 **TASK:** Rebuilds PTO.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given necessary tools and supplies and a tractor with power take-off drive,

EVALUATION: rebuild the power take-off drive.

STANDARD: The rebuilt must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing power take-off drive.
2. Identify the causes of the need to rebuild the power take-off drive.
3. Using a service manual, demonstrate how to disassemble PTO drive.
4. Inspect, remove, and replace any worn or damaged parts.
5. Demonstrate how to reassemble PTO drive.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Troubleshoot a power take-off drive.
2. Inspect PTO drive.
3. Following demonstration, have students rebuild the power take-off drive on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, solvent, lubricants, oil, needed equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.1 **TASK:** Rebuilds main pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the manufacturer's service manual, a clean working area, the necessary tools, replacement parts, and fluids,

EVALUATION: rebuild main pump.

STANDARD: There must be no damage to any parts and no dirt, lint, or chaff should enter the system. The pump must operate to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a hydraulic system on agricultural power equipment and machinery.
2. Discuss the three types (gear, vane, piston) of hydraulic pumps.
3. Demonstrate how to follow instructions in the manufacturer's service manual in regard to troubleshooting the pump to diagnose such problems as: cavitation; worn or damaged parts; noise; excessive wear; fluid delivery; absent, low, erratic pressure; excessive fluid leakage.
4. Demonstrate how to disassemble pump according to manufacturer's instructions and how to plug lines to keep dirt out of system.
5. Demonstrate how to reassemble pump, replacing seals and gaskets according to manufacturer's instruction.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Display and describe the three types of hydraulic pumps.
2. Rebuild main pump on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, necessary equipment, hydraulic fluid, and main hydraulic pump.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.2 **TASK:** Reseals main pump.

PERFORMANCE OBJECTIVE:

See Task 22.1.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.3 **TASK:** Replaces main pump.

PERFORMANCE OBJECTIVE:

See Task 22.1.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.4 **TASK:** Installs bushings.

PERFORMANCE OBJECTIVE:

See Task 22.1.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.5 **TASK:** Replaces belt.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a conveyance system, mechanic's tool set, needed parts and equipment, and service manual,

EVALUATION: replace the hydraulic pump belt.

STANDARD: Replace belt and adjust tension on the conveyance system so that the unit operates smoothly with no slippage, no excessive noise, and with freedom from binding.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a conveyance system's drive belts and pulleys.
2. Identify the causes of the need to adjust, or replace the belts.
3. List the steps in troubleshooting drive belts and pulleys.
4. Discuss the procedure outlined in the service manual for adjusting, or replacing the designated type of belt.
5. Demonstrate how to replace and adjust a drive belt in a conveyance system for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students torubleshoot a conveyance system.
2. Following a demonstration, have students replace belt and adjust tension on a hydraulic pump.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and conveyance system.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.6 **TASK:** Adjusts rockshaft housing control valves.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual and mechanic's tool set,

EVALUATION: adjust rockshaft housing control valves on designated tractor.

STANDARD: Adjust rockshaft housing control valves so that the machine operates within manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a hydraulic system on agricultural power equipment and machinery.
2. Identify the causes of the need to adjust rockshaft housing control valves.
3. List the steps in troubleshooting rockshaft housing control valves.
4. Discuss the procedure outlined in service manual for adjusting the designated rockshaft housing control valves.
5. Demonstrate how to adjust rockshaft housing control valves.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students inspect rockshaft housing control values.
2. Following a demonstration, have students troubleshoot rockshaft housing control values.
3. Following a demonstration, have students adjust rockshaft housing control valves on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.7 **TASK:** Replaces rockshaft.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, replacement parts, and needed equipment,

EVALUATION: replace rockshaft on designated tractor.

STANDARD: The replaced rockshaft must be installed and operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a hydraulic system on agricultural power equipment and machinery.
2. Identify the causes of the need to replace the rockshaft.
3. Discuss the procedure outlined in service manual for replacement of the designated rockshaft.
4. Demonstrate how to remove and replace a rockshaft.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students remove and inspect rockshaft.
2. Following a demonstration, have students troubleshoot rockshaft.
3. Following a demonstration, have students remove and replace rockshaft on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, needed equipment, hydraulic fluid, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.8 **TASK:** Replaces rockshaft housing.

PERFORMANCE OBJECTIVE:

See Task 22.7.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.9 **TASK:** Rebuilds valve linkage.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: rebuild valve linkage.

STANDARD: Rebuild the valve linkage so that the system operates within the manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a hydraulic system on agricultural power equipment and machinery.
2. Identify the causes of the need to replace/rebuild the valve linkage.
3. List the steps in troubleshooting the valve linkage.
4. Discuss the procedure outlined in service manual for rebuilding the designated valve linkage.
5. Demonstrate how to remove and rebuild a valve linkage.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students inspect valve linkage.
2. Following a demonstration, have students troubleshoot the valve linkage.
3. Following a demonstration, have students remove and rebuild the designated valve linkage.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, equipment, hydraulic fluid, clean rags, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.10 **TASK:** Adjusts control linkage.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, and a conveyance system,

EVALUATION: adjust control linkage.

STANDARD: Adjust control linkage so that the system operates within the manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a hydraulic system on agricultural power equipment and machinery.
2. Identify the causes of the need to adjust control linkage.
3. List the steps in troubleshooting the control linkage.
4. Discuss the procedure outlined in service manual for adjusting the designated control linkage.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students inspect control linkage.
2. Following a demonstration, have students troubleshoot control linkage.
3. Following a demonstration, have students adjust the designated control linkage.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, and conveyance system.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.11 **TASK:** Reseals piston.

PERFORMANCE OBJECTIVE:

See Task 22.36.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.12 **TASK:** Replaces control cam and lock bolt.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a new control cam and lock bolt, mechanic's tool set, and necessary equipment,

EVALUATION: replace control cam and lock bolt.

STANDARD: The replaced control cam and lock bolt must operate to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of replacing control cam and lock bolt.
2. Identify the causes of the need to replace control cam and lock bolt.
3. List the steps in troubleshooting a control cam and lock bolt.
4. Discuss the procedure outlined in service manual for replacing the designated control cam and lock bolt.
5. Demonstrate how to remove and replace control cam and lock bolt.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students inspect a control cam and lock bolt.
2. Following a demonstration, have students troubleshoot a control cam and lock bolt.
3. Following a demonstration, have students replace control cam and lock bolt on designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, necessary equipment, hydraulic fluid, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.13 **TASK:** Replaces bushings and seals.

PERFORMANCE OBJECTIVE:

See Task 22.1, and 22.36.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.14 **TASK:** Adjusts steering valve.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, necessary tools, and tractor,

EVALUATION: adjust steering valve.

STANDARD: The steering valve must be adjusted and operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a hydraulic system on agricultural power equipment and machinery.
2. Identify the causes of the need to adjust steering valve.
3. List the steps in troubleshooting the steering valve and control unit.
4. Discuss the procedure outlined in service manual for adjusting the designated steering valve.
5. Demonstrate how to adjust steering valve.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students inspect steering valve.
2. Following a demonstration, have students troubleshoot steeering valve and control unit.
3. Following a demonstration, have students adjust steering valve on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, necessary tools and equipment, hydraulic fluid, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.15 **TASK:** Replaces valve seats.

PERFORMANCE OBJECTIVE:

See Task 22.1.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.16 **TASK:** Rebuilds steering valve.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: rebuild steering valve on designated tractor.

STANDARD: The rebuilt steering valve must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a hydraulic system on agricultural power equipment and machinery.
2. Identify the causes of the need to rebuild steering valve.
3. List the steps in troubleshooting the steering valve and control unit.
4. Discuss the procedure outlined in service manual for rebuilding steering valve.
5. Demonstrate how to remove and rebuild steering valve.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students remove and inspect steering valve.
2. Following a demonstration, have students troubleshoot steeering valve.
3. Following a demonstration, have students rebuild steering valve on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and tools and equipment, hydraulic fluid, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.17 **TASK:** Replaces steering valve.

PERFORMANCE OBJECTIVE:

See Task 22.16.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.18 **TASK:** Reseals steering valve.

PERFORMANCE OBJECTIVE:

See Task 22.19.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.19 **TASK:** Rebuilds steering cylinder.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a hydraulic testing machine, a service manual, replacement parts, and necessary tools,

EVALUATION: rebuild steering cylinder.

STANDARD: Demonstrate how to rebuild a steering cylinder so that it does not leak and it operates to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a hydraulic system on agricultural power equipment and machinery.
2. Demonstrate how to test and diagnose the specific problem on a hydraulic testing machine, following instructions in the manufacturer's service manual and those that come with the testing machine.
3. Discuss the causes of problems with steering cylinders.
4. Demonstrate how to remove and rebuild a steering cylinder.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Rebuild a steering cylinder on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, hydraulic testing machine, replacement parts, hydraulic fluid, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.20 **TASK:** Replaces steering cylinder.

PERFORMANCE OBJECTIVE:

See Task 22.19.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.21 **TASK:** Reseals steering pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the manufacturer's service manual, a clean working area, the necessary tools, replacement parts, and fluids,

EVALUATION: reseal steering pump.

STANDARD: There must be no damage to any parts and no dirt, lint, or chaff should enter the system. The steering pump must operate as specified.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a hydraulic system on agricultural power equipment and machinery.
2. Demonstrate how to follow instruction in the manufacturer's service manual in regard to troubleshooting the steering pump to diagnose such problems as: improper fluid level; fluid contamination; seal damage; overleading or overspeeding; cavitation; worn or damaged parts; noise; excessive wear; fluid delivery; absent, low, or erratic pressure; excessive fluid leakage.
3. Demonstrate how to disassemble steering pump according to manufacturer's specifications and how to plug lines to keep dirt out of the system.
4. Demonstrate how to reassemble steering pump, replacing seals and gaskets according to manufacturer's specification.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Reseal steering pump on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, clean working area, replacement parts, hydraulic fluid, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.22 **TASK:** Repairs steering pump.

PERFORMANCE OBJECTIVE:

See Task 22.21.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.23 **TASK:** Replaces steering motor bearings.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the manufacturer's service manual, testing equipment, necessary tools, replacement parts, and fresh oil,

EVALUATION: replace steering motor bearings on designated tractor.

STANDARD: All parts must be cleaned and worn or damaged parts replaced. The pressure, speed, torque, displacement, load and temperature must be adjusted to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the three basic typed (gears, vane, piston) of hydraulic motors.
2. Discuss the safety aspects of servicing/repairing a hydraulic system on agricultural power equipment and machinery.
3. Troubleshoot the motor (following instructions in the service manual) for causes of motor failure, slow motor operation, erratic motor operation, motor turning in wrong direction, motor shaft not turning, and motor mounts for wear or damage.
4. Explain how to remove and disassemble steering motor, following instruction in the service manual.
5. Discuss how to clean and inspect all parts and how to replace all worn or damaged parts.
6. Demonstrate how to reassemble motor in order recommended and how to replace all seals and gaskets with new ones.
7. Demonstrate how to replace old oil with new.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Replace steering motor bearings on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, testing equipment, necessary tools, replacement parts, fresh oil, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.24 **TASK:** Replaces steering motor mounts.

PERFORMANCE OBJECTIVE:

See Task 22.23.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.25 **TASK:** Rebuilds breakaway couplers.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: rebuild breakaway couplers.

STANDARD: The breakaway couplers must function within manufacturer's specifications and without oil leaks.

STUDENT LEARNING EXPERIENCES:

1. Discuss the saftey aspects of replacing a breakaway coupler.
2. Identify the causes of the need to replace a breakaway coupler.
3. List the steps in troubleshooting a breakaway coupler.
4. Discuss the procedure outlined in service manual for rebuilding a breakaway coupler.
5. Demonstrate how to remove and rebuild a breakaway coupler.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students remove and inspect a breakaway coupler.
2. Following a demonstration, have students troubleshoot a breakaway coupler.
3. Following a demonstration, have students rebuild a breakaway coupler.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, hydraulic fluid, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.26 **TASK:** Installs breakaway coupler.

PERFORMANCE OBJECTIVE:

See Task 22.25.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.27 **TASK:** Adjusts linkage of selective control valve.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, and a conveyance system,

EVALUATION: adjust linkage of selective control valve.

STANDARD: Adjust linkage of selective control valve so that the system operates within the manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the saftey aspects of servicing/repairing a hydraulic system on agricultural power equipment and machinery.
2. Identify the causes of the need to adjust linkage of selective control valve.
3. List the steps in troubleshooting the selective control valve.
4. Discuss the procedure outlined in service manual for adjusting linkage of selective control valve on designated conveyance system.
5. Demonstrate how to adjust linkage of selective control valve.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students inspect selective control valve.
2. Following a demonstration, have students troubleshoot selective control valve.
3. Adjust linkage of selective control valve on designated conveyance system.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, hydraulic fluid, and conveyance system.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.28 **TASK:** Rebuilds coupler.

PERFORMANCE OBJECTIVE:

See Task 22.25.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.29 **TASK:** Rebuilds selective control valve.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, and needed parts and equipment,

EVALUATION: rebuild selective control valve.

STANDARD: The rebuilt selective control valve must operate within manufacturer's specifications and without oil leaks.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of replacing a selective control valve on designated tractor.
2. Identify the causes of the need to replace selective control valve.
3. List the steps in troubleshooting a selective control valve.
4. Discuss the procedure outlined in service manual for rebuilding selective control valve.
5. Demonstrate how to remove and rebuild selective control valve.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students remove and inspect selective control valve.
2. Following a demonstration, have students troubleshoot selective control valve.
3. Following a demonstration, have students rebuild selective control valve.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, hydraulic fluid, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.30 **TASK:** Installs selective control valve.

PERFORMANCE OBJECTIVE:

See Task 22.29.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.31 **TASK:** Reseals main valve.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given correct wrenches, service manual, micrometer, hand hydraulic pump with pressure gauge, fittings to attach pump to valve, hydraulic fluid, repair parts, and clean rags,

EVALUATION: reseal main valve on designated tractor.

STANDARD: The resealed main valve must be installed so that hydraulic circuits work according to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a hydraulic system on agricultural power equipment and machinery.
2. Explain how to clean valve unit and remove from system, make sure line is plugged to prevent contamination of hydraulic system.
3. Demonstrate how to remove the bolts from valve bank.
4. Demonstrate how to remove caps and spools from section and how to assure that spool moves evenly and smoothly.
5. Discuss how to check spools for cracks, scratches, and straightness and how to assure that end sealing surfaces are smooth. If necessary, remove and replace seals.
6. Demonstrate how to polish a rough spool with fine emery cloth, making sure the diameter of the spool is not reduced significantly.
7. Discuss how to check diameter of spools and how to replace entire section if they are not within specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Identify the defective main valve on the designated tractor.
2. Display the three basic types of valves.
3. Read the appropriate shop manual or manufacturer's service manual for information on service and repair of hydraulic valves.
4. Reseal main valve on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, micrometer, hand hydraulic pump with pressure gauge, fittings to attach pump to valve, hydraulic fluid, repair parts, clean rags, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.32 **TASK:** Replaces main valve.

PERFORMANCE OBJECTIVE:

See Task 22.31.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.33 **TASK:** Changes fluid filter.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the new filters recommended in the manufacturer's service manual, necessary tools, new parts, and clean oil,

EVALUATION: change the hydraulic oil filters.

STANDARD: The new filters must be the type recommended in the service manual. They must be installed correctly and must function as specified.

STUDENT LEARNING EXPERIENCES:

1. Discuss why the location of the filters varies with the design of the machine.
2. Explain how to remove all parts necessary to reach and remove old filters.
3. Demonstrate how to install the filters recommended by the manufacturer, following instructions in the service manual.
4. Discuss the necessity of following the manufacturer's recommendation if oil change in the hydraulic system is indicated.
5. Demonstrate how to reassemble and reinstall all parts removed.
6. Demonstrate how to check operation of hydraulic system and how to check for leaks.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Consult the appropriate shop manual or the manufacturer's service guide for information pertaining to changing hydraulic filters.
2. Change the hydraulic filters on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement filters, new parts, clean oil, rags, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.34 **TASK:** Adjusts pressure.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts, and a hydrostatic drive,

EVALUATION: service/repair the pressure control valve.

STANDARD: The pressure control valve must operate within manufacturer's specifications and no oil leaks should be present. Pressure must be set in accordane with service manual.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing, repairing or replacing the charge pressure control valve.

2. Identify the causes of the need to replace a pressure control valve.

3. List the steps in troubleshooting control value.

4. Discuss the procedure outlined in service manual for replacement of the designated control valve.

5. Demonstrate how to reassemble charge pressure control valve and replace in machine for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students remove and inspect control valve.

2. Following a demonstration, have students troubleshoot control value.

3. Following a demonstration, have students reassemble and replace charge pressure control value in machine.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts, clean rags, hydraulic fluids, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.35 **TASK:** Replaces hoses/pipe.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given new hoses/pipe, necessary tools, replacement parts, and hydraulic oil,

EVALUATION: replace the hoses/pipe.

STANDARD: The hydraulic hoses/pipe must be replaced so that it does not leak under operating pressure.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a hydraulic system on agricultural power equipment and machinery.
2. Identify faulty hoses/pipe.
3. Discuss how to check abrasions, cuts, leaks, and fittings.
4. Explain when it is necessary to replace hoses/pipe.
5. Demonstrate how to remove hoses/pipe.
6. Demonstrate how to install a fitting to the hoses/pipe.
7. Demonstrate how to replace the hoses/pipe.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students replace hydraulic hoses/pipe on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, hydraulic fluid, clean rags, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.36 **TASK:** Rebuilds cylinder.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a hydraulic testing machine, a service manual, replacement parts, and necessary tools,

EVALUATION: replace a hydraulic cylinder.

STANDARD: The repaired hydraulic cylinder must be disassembled and reassembled in accordance with manufacturer's instructions. The cylinder must not leak and it must operate correctly.

STUDENT LEARNING EXPERIENCES:

1. Discuss the two main types (piston and vane) of hydraulic cylinders.

2. Demonstrate how to test and diagnose the specific problem on a hydraulic testing machine, following instructions in the manufacturer's service manual and those that come with the testing machine.

3. Discuss possible causes of and cures for problems with hydraulic cylinders.

4. Demonstrate how to complete specific repairs such as outside leaks, internal leaks, cylinder creeping, sluggish operation, loose mounting, misalignment, lack of lubrication, abrasives on rods, burns on rod.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Display and discuss vane and piston hydraulic cylinders.

2. Repair a hydraulic cylinder on the designated tractor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, hydraulic fluid, clean rags, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.37 **TASK:** Reseals cylinder.

PERFORMANCE OBJECTIVE:

See Task 22.36.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.38 **TASK:** Replace cylinder.

PERFORMANCE OBJECTIVE:

See Task 22.36.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.39 **TASK:** Replaces feedback cylinder.

PERFORMANCE OBJECTIVE:

See Task 22.36.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

22.0 **COMPETENCY/SKILL:** Services/repairs the hydraulic system on tractors and traction units needed for agricultural operations.

22.40 **TASK:** Charges accumulator.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, necessary parts and equipment, and a nitrogen bottle,

EVALUATION: charge accumulator.

STANDARD: The accumulator must operate within manufacturer's specifications and without leaks.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of charging an accumulator.
2. Identify the causes of the need to charge accumulator.
3. List the steps in troubleshooting an accumulator.
4. Discuss the procedure outlined in service manual for charging the designated accumulator.
5. Demonstrate how to charge accumulator for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students inspect an accumulator.
2. Following a demonstration, have students troubleshoot an accumulator.
3. Have students charge the designated accumulator.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, nitrogen bottle, necessary parts and equipment, and tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

23.0 COMPETENCY/SKILL: Services/repairs planters needed for agricultural operations.

23.1 TASK: Sets up planter.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given planter needing assembly, operator's manual, assembly manual, mechanic's tool set, 10' tape measure, and grease gun,

EVALUATION: assemble designated planter.

STANDARD: The planter must plant seed at regular intervals and at depths consistent with needs of crops being planted, as prescribed in operator's manual.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of assembling planting equipment.
2. Discuss the steps involved in assembling planting equipment.
3. Demonstrate how to make all adjustments specified for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following demonstration, have students assemble planting equipment.
2. Following a demonstration, have students make adjustments to specifications on the designated planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, mechanic's tool set, assembly manual, tape measure 10 feet in length, grease gun, and planter.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

23.0 **COMPETENCY/SKILL:** Services/repairs planters needed for agricultural operations.

23.2 **TASK:** Adjusts row spacing.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given planter, operator's manual, and mechanic's tool set,

EVALUATION: adjust row spacing on designated planter.

STANDARD: When adjusted, the planter must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of adjusting a planter.
2. Identify the causes of the need to adjust row spacing.
3. List the steps in troubleshooting a planter.
4. Discuss the procedures outlined in operator's manual for adjusting row spacing.
5. Demonstrate how to adjust a planter's row spacing for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students troubleshoot planter's operation.
2. Following a demonstration, have students adjust row spacing on the designated planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, mechanic's tool set, and planter.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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23.0 **COMPETENCY/SKILL:** Services/repairs planters needed for agricultural operations.

23.3 **TASK:** Rebuild electronic monitors.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, replacement parts, necessary equipment and planter,

EVALUATION: rebuild electronic monitors.

STANDARD: The electronic monitors must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a planter.
2. Identify the causes of the need to rebuild electronic monitors.
3. List the steps in troubleshooting an electronic monitor system.
4. Discuss the procedures outlined in service manual for rebuilding an electronic monitor system.
5. Demonstrate how to remove, rebuild, and replace electronic monitors.
6. Demonstrate how to adjust electronic monitors for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Inspect electronic monitors.
2. Following a demonstration, have students troubleshoot electronic monitors on the designated planter.
3. Following a demonstration, have students rebuild electronic monitors on the designated planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, needed equipment, and planter.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

23.0 **COMPETENCY/SKILL:** Services/repairs planters needed for agricultural operations.

23.4 **TASK:** Replaces monitor sensor.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, planter, and replacement monitor sensor,

EVALUATION: the monitor sensor unit must be adjusted to manufacturer's specifications.

STANDARD:

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a planter.
2. Identify the causes of the need to replace monitor sensor.
3. List the steps in troubleshooting a monitor sensor.
4. Discuss the procedures outlined in service manual for replacing a monitor sensor.
5. Demonstrate how to remove and replace monitor sensor.
6. Demonstrate how to adjust a monitor sensor for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students inspect a monitor sensor.
2. Following a demonstration, have students troubleshoot a monitor sensor.
3. Following a demonstration, have students replace a monitor sensor on the designated planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, planter, and replacement monitor sensor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

23.0 **COMPETENCY/SKILL:** Services/repairs planters needed for agricultural operations.

23.5 **TASK:** Rebuilds monitor harness.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, necessary parts and equipment,

EVALUATION: rebuild monitor harness.

STANDARD: The rebuilt monitor harness must be installed to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing agricultural power equipment and machinery.
2. Identify the causes of the need to rebuild/replace a monitor harness.
3. List the steps in troubleshooting a monitor.
4. Discuss the procedures outlined in service manual for rebuilding a monitor harness.
5. Demonstrate how to adjust a monitor for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Inspect monitor harness.
2. Following a demonstration, have students rebuild monitor harness on designater planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, necessary parts and equipment, and planter.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

23.0 **COMPETENCY/SKILL:** Services/repairs planters needed for agricultural operations.

23.6 **TASK:** Installs monitor.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, planter, and new monitor,

EVALUATION: install monitor.

STANDARD: The monitor must be installed and operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing agricultural power equipment and machinery.
2 Identify the causes of the need to install a monitor.
3. List the steps in troubleshooting a monitor.
4. Discuss the procedures outlined in service manual for installing a monitor.
5. Demonstrate how to install a monitor.
6. Demonstrate how to adjust a monitor for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Inspect a monitor.
2. Following a demonstration, have students troubleshoot a monitor.
3. Following a demonstration, have students install and adjust monitor on the designated planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement monitor, and planter.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

23.0 **COMPETENCY/SKILL:** Services/repairs planters needed for agricultural operations.

23.7 **TASK:** Installs disc cappers.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, and needed parts,

EVALUATION: install disc cappers on designated planter.

STANDARD: Install disc cappers on planter so that the unit is adjusted to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of installing disc cappers.
2. Identify the causes of the need to install/replace disc cappers.
3. List the steps in troubleshooting disc cappers.
4. Discuss the procedures outlined in service manual for installing disc cappers.
5. Demonstrate how to install disc cappers.
6. Demonstrate how to adjust disc cappers for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Inspect disc cappers.
2. Following a demonstration, have students troubleshoot disc cappers.
3. Following a demonstration, have students install disc cappers on the designated planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts, and planter.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

23.0 **COMPETENCY/SKILL:** Services/repairs planters needed for agricultural operations.

23.8 **TASK:** Replaces gauge wheel.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an assembly manual, mechanic's tool set, and replacement part,

EVALUATION: replace the gauge wheel on designated planter.

STANDARD: The gauge wheel must be adjusted so that planter unit operates in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of replacing a gauge wheel
2. Identify the causes of the need to replace a gauge wheel.
3. List the steps in troubleshooting a gauge wheel.
4. Discuss the procedures outlined in service manual for replacing a gauge wheel.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students inspect a gauge wheel for proper operation.
2. Following a demonstration, have students troubleshoot a gauge wheel.
3. Following a demonstration, have students replace and adjust a gauge wheel on the designated planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Assembley manual, mechanic's tool set, replacement gauge wheel, and planter.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

23.0 **COMPETENCY/SKILL:** Services/repairs planters needed for agricultural operations.

23.9 **TASK:** Replaces coverers.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, replacement coverers,

EVALUATION: replace coverers on designated planter.

STANDARD: Replace coverers must be adjusted so that planter unit operates in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of replacing coverers on planter.
2. Discuss the four common seed covering devices (shovel, knife, disc, and chain).
3. Identify the causes of the need to replace a coverer.
4. List the steps in troubleshooting coverers.
5. Discuss the procedures outlined in service manual for replacing coverers.
6. Demonstrate how to adjust coverers for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students remove and inspect a seed covering device.
2. Following a demonstration, have students troubleshoot coverers on the designated planter.
3. Following a demonstration, have students replace and adjust coverers on the designated planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement coverers, and planter.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

23.0 **COMPETENCY/SKILL:** Services/repairs planters needed for agricultural operations.

23.10 **TASK:** Installs hydraulic system tubes.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, needed parts, necessary tools and equipment,

EVALUATION: install hydraulic system tubes on designated planter.

STANDARD: The hydraulic system tubes must be installed and operate in accordance with manufacturer's specifications. There must be no oil leaks.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a hydraulic system on agricultural power equipment and machinery.
2. Identify the causes of the need to install/replace the hydraulic system tubes.
3. List the steps in troubleshooting hydraulic system tubes.
4. Discuss the procedures outlined in the service manual for installing hydraulic system tubes.
5. Demonstrate how to install hydraulic system tubes.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Inspect hydraulic system tubes.
2. Troubleshoot hydraulic system tubes on the designated planter.
3. Following a demonstration, have students install hydraulic system tubes on the designated planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, hydraulic fluid, and planter.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

23.0 **COMPETENCY/SKILL:** Services/repairs planters needed for agricultural operations.

23.11 **TASK:** Installs seed box levers.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given assembly manual, mechanic's tool set, and needed parts,

EVALUATION: install seed box levers on designated planter.

STANDARD: The installed seed box levers must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a planter.
2. Identify the causes of the need to install/repair seed box levers.
3. List the steps in troubleshooting seed box levers.
4. Discuss the procedures outlined in service manual for installing seed box levers.
5. Demonstrate how to install seed box levers.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students inspect seed box levers.
2. Following a demonstration, have students install seed box levers on the designated planter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Assembly manual, mechanic's tool set, needed parts, and planter.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

23.0 **COMPETENCY/SKILL:** Services/repairs planters needed for agricultural operations.

23.12 **TASK:** Installs drag chains.

PERFORMANCE OBJECTIVE:

See Task 23.9.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

23.0 **COMPETENCY/SKILL:** Services/repairs planters needed for agricultural operations.

23.13 **TASK:** Installs grain seeder.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, necessary tools and equipment, and a broadcast seeder,

EVALUATION: install grain seeder.

STANDARD: The installed grain seeder must be adjusted and operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of installing a grain seeder.
2. List the steps in troubleshooting a grain seeder.
3. Discuss the procedures outlined in service manual for installing a grain seeder.
4. Demonstrate how to install a grain seeder.
5. Demonstrate how to adjust a grain seeder.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students inspect a grain seeder.
2. Troubleshoot a grain seeder.
3. Following a demonstration, have students install grain seeder.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, necessary tools and equipment, broadcast seeder, and planter or tractor.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

24.0 **COMPETENCY/SKILL:** Services/repairs primary tillage equipment needed for agricultural operations.

24.1 **TASK:** Sets up tillage equipment.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given primary tillage equipment needing assembly, assembly manual, operator's manual, mechanic's tool set, tape measure, 3/4 inch drive socket set, and tractor,

EVALUATION: assemble primary tillage equipment.

STANDARD: The tillage equipment must perform soil preparation as specified in operator's manual.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of assembling primary tillage equipment.
2. Assemble primary tillage equipment.
3. Demonstrate how to make all adjustments specified for proper operation.
4. Identify primary tillage equipment.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following demonstration, have students assemble primary tillage equipment.
2. Following demonstration, have students make adjustments to specifications.
3. Following demonstration, have students identify primary tillage equipment.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, assembly manual, primary tillage equipment, tape measure, 3/4 inch drive socket set, mechanic's tool set, and tractor.

RESOURCES:

Walker, Hattie M. et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Richmond: Agricultural Education Service, Department of Education, 1983.

24.0 **COMPETENCY/SKILL:** Services/repairs primary tillage equipment needed for agricultural operations.

24.2 **TASK:** Prepares tillage equipment.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given primary tillage equipment, assembly manual, operator's manual, mechanic's tool set,

EVALUATION: prepare tillage equipment.

STANDARD: Tillage equipment must operate in accordance with manufacturer's specifications. Replace worn or damaged parts and torque to specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of preparing primary tillage equipment.
2. Lubricate to specifications.
3. Inflate tires to recommended pressure.
4. Clean, inspect, lubricate, and tighten wheel and bearings. Replace as needed.
5. Remove any rust, paint, or other protective coatings from moldboards, shares, and landsides to assist scouring.
6. Replace dull or broken shares and sharpen coulters if necessary. After replacing shares, always retighten bolts again after one or two round.
7. Check all bolts for tightness, expecially on bottoms and standards. Replace badly worn or broken parts.
8. Check bottom alignment, shares pointing up or down, to left or right. Measure vertical distance from share point to frame on all bottoms; distance between top corners of moldboards and between moldboard tips; also the distance from share point to share point.
9. Replace bent or cracked frogs, standards or beams.
10. Hand-release each safety-trip standard to be sure it functions freely.
11. Check nitrogen supply in hydraulic accumulator on all new automatic-reset plows.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following demonstration, have students prepare primary tillage equipment.
2. Following demonstration, have students make adjustments to specifications.
3. Following demonstration, have students identify primary tillage equipment.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, assembly manual, primary tillage equipment, mechanic's tool set, and tractor.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: TILLAGE. John Deere and Company, Moline, IL. 1976.

24.0 **COMPETENCY/SKILL:** Services/repairs primary tillage equipment needed for agricultural operations.

24.3 **TASK:** Checks hydraulic system.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, operator's manual, mechanic's tool set, needed parts and equipment,

EVALUATION: check hydraulic system on designated tractor and primary tillage equipment.

STANDARD: All worn or damaged parts must be replaced and hydraulic system must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of assembling primary tillage equipment and hydraulic system.

2. Check hydraulic system. Clean or replace filter, check oil level, check compatability of pump capacity and pressure, and examine all hoses, couplings, and cylinders for leaks. Repair or replace as necessary.

3. Determine if tractor hydraulic-system pressure and capacity are adequate for automatic-reset plows. Be sure all hoses are properly connected.

4. Adjust tractor lift links and top link to suggested starting lengths for integral and semi-integral plows. Raise 3-point hitch as high as possible to clear drawbar when using drawn plows.

5. Adjust drawbar to recommended height for drawn plows.

6. Select load-and-depth or draft-control setting on tractor hydraulic system.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the safety aspects of servicing/repairing the hydraulic system.
2. Following demonstration, have students check hydraulic system.
3. Following demonstration, have students identify primary tillage equipment.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, operator's manual, mechanic's tool set, needed parts and equipment, tractor and primary tillage equipment.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: TILLAGE. John Deere and Company, Moline, IL. 1976.

24.0 **COMPETENCY/SKILL:** Services/repairs primary tillage equipment needed for agricultural operations.

24.4 **TASK:** Replaces moldboard components.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, operator's manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace moldboard components on designated plow assembly.

STANDARD: The plow assembly must perform in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the saftey aspects of servicing/repairing primary tillage equipment.
2. Inspect, repair or replace parts as needed.
3. Replace dull or broken shares and sharpen coulters.
4. Check all bolts for tightness, especially on bottoms and standards. Replace badly worn or broken parts.
5. Replace bent or cracked frogs, standards or beams.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the safety aspects of servicing/repairing primary tillage equipment.
2. Inspect, repair or replace parts as needed.
3. Replace dull or broken shares and sharpen coulters.
4. Check all bolts for tightness, especially on bottoms and standards. Replace badly worn or broken parts.
5. Replace bent or cracked frogs, standards or beams.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, operator's manual, mechanic's tool set, moldboard and components, necessary equipment, and plow assembly.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: TILLAGE. John Deere and Company, Moline, IL. 1976.

24.0 **COMPETENCY/SKILL:** Services/repairs primary tillage equipment needed for agricultural operations.

24.5 **TASK:** Replaces shanks.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given operator's manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace shanks on designated plow assembly.

STANDARD: Replaced shanks on designated plow assembly will provide a symmetrical shank arrangement on each side of the machine. For extremely hard soils the same number of shanks will be installed on each side of the plow to maintain a balanced load.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of repairing/servicing primary tillage equipment.
2. Discuss the importance that, "symmeterical shank arrangement provides uniform draft."
3. Determine the center of load of a chisel plow. (Locate the midpoint of the overall operating width. This point must be located on the centerline of the plow, directly behind the tractor hitchpoint, to keep the plow from veering to one side or the other in hard soil.)
4. Assemble a chisel plow to provide symmetrical shank arrangement on each side of the machine.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the various shank types on many current plows.
2. Following demonstratios, have students check shanks on a chisel plow.
3. Following demonstration, have students replace shanks on designated chisel plow.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, mechanic's tool set, replacement shanks, needed parts and equipment, and plow assembly.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: TILLAGE. John Deere and Company, Moline, IL. 1976.

24.0 **COMPETENCY/SKILL:** Services/repairs primary tillage equipment needed for agricultural operations.

24.6 **TASK:** Replaces shank points.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given operator's manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace shank points on designated plow assembly.

STANDARD: Replaced shank points on designated plow assembly will be installed and operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of assembling primary tillage equipment.
2. Discuss the importance of preventive maintenance for tillage equipment.
3. Check for loose nuts and bolts and worn, broken, or missing parts.
4. Sharpen or replace dull or broken shank points.
5. Lubricate machine as recommended in service manual.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the importance of preventive maintenance for tillage equipment.
2. Following demonstration, have students check shank points on designated primary tillage equipment.
3. Following demonstration, have students replace shank points on designated primary tillage equipment.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, mechanic's tool set, replacement shank points, needed parts and equipment, and plow assembly.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: TILLAGE. John Deere and Company, Moline, IL. 1976.

25.0 **COMPETENCY/SKILL:** Services/repairs secondary tillage equipment needed for agricultural operations.

25.1 **TASK:** Sets up tillage equipment.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given secondary tillage equipment needing assembly, operator's manual, assembly manual, mechanic's tool set, 3/4 inch drive socket set, grease gun, and means of lifting and supporting frame,

EVALUATION: assemble secondary tillage equipment.

STANDARD: Assemble secondary tillage equipment in such a manner that it provides soil preparation in accordance with specifications in operator's manual.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of assembling secondary tillage equipment.
2. Assemble secondary tillage equipment.
3. Demonstrate how to make all adjustments specified for proper operation.
4. Identify pieces of secondary tillage equipment.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following demonstration, have students assemble secondary tillage equipment.
2. Following demonstration, have students make adjustments to specifications.
3. Following demonstration, have students identify secondary tillage equipment.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, assembly manual, mechanic's tool set, 3/4 inch drive socket set, grease gun, jacks and lift support equipment, and plow assembly.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

25.0 **COMPETENCY/SKILL:** Services/repairs secondary tillage equipment needed for agricultural operations.

25.2 **TASK:** Checks electrical system.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a set of screwdrivers, pliers, wrenches, and a continuity-tester ohmmeter,

EVALUATION: check the electrical system on the designated tractor and tillage equipment.

STANDARD: Instrument readings must be in accordance with those of the instructor's.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate how to connect tillage electrical system to tractor.
2. Explain how to attach continuity tester across terminals.
3. Discuss how to activate switch and check for contact.
4. Demonstrate how to replace electrical receptacle if damaged or broken.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Check the appropriate shop manual or manufacturer's service manual for the correct allowable resistance.
2. Check the electrical system on designated equipment.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, set of screwdrivers, pliers, wrenches, continuity-tester ohmmeter, designated tractor and tillage equipment.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

25.0 **COMPETENCY/SKILL:** Services/repairs secondary tillage equipment needed for agricultural operations.

25.3 **TASK:** Checks hydraulic system.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, operator's manual, mechanic's tool set, needed parts and equipment,

EVALUATION: check hydraulic system on designated tractor and secondary tillage equipment.

STANDARD: All worn or damaged parts must be replaced and hydraulic system must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of assembling secondary tillage equipment and hydraulic system
2. Demonstrate how to check hydraulic system.
3. Examine hydraulic hoses, couplings, and cylinders for wear, damage, or leaks. Repair and replace as needed.
4. Determine if tractor hydraulic-system pressure and capacity are adequate for automatic-reset plows.
5. Be sure all hoses are properly connected.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the safety aspects of servicing/repairing the hydraulic system.
2. Following demonstration, have students check hydraulic system.
3. Following demonstration, have students identify secondary tillage equipment.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, operator's manual, mechanic's tool set, needed parts and equipment, hydraulic fluid, tractor and secondary tillage equipment.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: TILLAGE. John Deere and Company, Moline, IL. 1976.

25.0 **COMPETENCY/SKILL:** Services/repairs secondary tillage equipment needed for agricultural operations.

25.4 **TASK:** Installs stop kit.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, operator's manual, mechanic's tool set, needed parts and equipment,

EVALUATION: install stop kit on designated secondary tillage equipment.

STANDARD: Installed stop kit will operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of assembling secondary tillage equipment and hydraulic system.
2. Discuss how to install stop kit.
3. Install stop kit.
4. Demonstrate how to make all adjustments specified for proper operations.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following demonstration, have students install stop kit.
2. Following demonstration, have students make adjustments to specifications.
3. Following demonstration, have students identify secondary tillage equipment.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, operator's manual, mechanic's tool set, stop kit, needed parts and equipment, secondary tillage equipment.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

25.0 **COMPETENCY/SKILL:** Services/repairs secondary tillage equipment needed for agricultural operations.

25.5 **TASK:** Installs sweeps.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given operator's manual, mechanic's tool set, needed parts and equipment,

EVALUATION: install sweeps on designated tillage equipment.

STANDARD: Installed sweeps on designated plow assembly will provide a symmetrical arrangement on each side of the machine. Sweeps will operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of assembling secondary tillage equipment.
2. Discuss the importance of symmetrical arrangement for uniform draft.
3. Determine the center of load of sweep plow.
4. Assemble sweep plow to provide symmetrical arrangement on each side of the machine.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the various sweep-plow types and sizes.
2. Following demonstration, have students check sweeps on secondary tillage equipment.
3. Following demonstration, have students install sweeps on designated tillage equipment.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, mechanic's tool set, needed parts and equipment, and tillage equipment.

RESOURCES:

FUNDAMENTALS OF MACHINE OPERATION: TILLAGE. John Deere and Company, Moline, IL. 1976.

26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.1 **TASK:** Disassembles picker head.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, instruction in safe operation of power tools, necessary equipment, and a cotton picker,

EVALUATION: disassemble picker head.

STANDARD: Demonstrate safety practice. Disassembly will be according to manufacturer's specifications and instruction specified by instructor.

STUDENT LEARNING EXPERIENCES:

1. Remove cross shaft shield.
2. Loosen clamp, and discounnect tube from inner suction duct.
3. Remove lower duct.
4. Remove spring pins from rocker arm coupler.
5. Remove front and rear spacers and grates (4 bolts each).
6. Separate moistner tubes, and (if equipped) lubrication tubes.
7. Disconnect monitor wires, and (if equipped) field light wires.
8. Remove two tie beam bolts at INNER units only. Remove and save any shims at bottom of tubes at inner units.

   NOTE: Use same shims when installing units. If units hang more than one-half hole too close at bottom tie plates, and shims as needed.

9. Remove spring pin and cap screw holding turn buckle to OUTER unit. This provides an attaching point for a lift chain.
10. Attach lift chains to unit at three points, similar to manner shown.

    CAUTIONS: Use lifting equipment with at least (900kg) 2000 lbs. capacity, and handle unit carefully to avoid damage. If lift brackets are not available, attach chain to unit in three places to balance, and avoid damage to sheet metal components.

11. Take up slack in chains and pry unit at tie beams to free it.

NOTE: Remove sprockets and unit drive coupling shaft as units separate.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on picker head in the manufacturer's service manual.

2. Discuss the safety aspects of picker head disassembly.

3. With the help of the Student Learning Tasks and service manual, disassemble picker head.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, power tools, necessary equipment, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

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26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.2 **TASK:** Steam cleans/paints picker head.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a picker head set-up to be repainted, steam cleaner unit, gun, respirator, and compressed air source,

EVALUATION: steam clean and paint picker head.

STANDARD: The completed steam cleaning should leave picker head clean. The completed paint job should be smooth, glossy, and with only minor runs.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate shop safety procedures.
2. Discuss precaution used when steam cleaning agricultural equipment.
3. Prepare picker head for steam cleaning.
4. Check area for safe operation of cleaning unit.
5. Clean picker head.
6. Allow for picker head to dry.
7. Sand and primer head as necessary.
8. Check room to proper temperature and humidity levels.
9. Set up paint gun.
10. Set air pressure.
11. Turn on exhaust system.
12. Thin paint if needed.
13. Fill gun reservoir through strainer.
14. Put on respirator.
15. Adjust gun.
16. Paint tractor.
17. Clean gun.

18. Put away equipment.

19. Do not move picker head until paint is dry.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss shop safety procedures.

2. Discuss precaution used when steam cleaning agricultural equipment.

3. Answer the following questions:

   A. What tools are required for spray painting?
   B. How far should you hold the spray gun from the painting surface when painting?
   C. Why should you always hold the spray gun at 90 degrees from the painting surface when painting?
   D. Describe how you would clean the spray gun.

4. In the paint area of the shop, paint the picket head.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, steam cleaner unit, solvent, gun, respirator, air compressor, paint, and picker head.

RESOURCES:

McCann, Edward W., et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.3 **TASK:** Lubricates picker head.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, rags, manufacturer's recommended lubricant, hand grease gun,

EVALUATION: lubricate picker head.

STANDARD: Lubricate picker head to manufacturer's specifications. There should be no dirt or excess grease on fittings.

STUDENT LEARNING EXPERIENCES:

1. Discuss the importance of proper maintenance of the lubrication system of picker head.
2. Prior to lubrication, clean all fittings of dirt and grease.
3. Picking unit rockshaft bearings, lubricate with serveral shots of grease with hand gun.
4. Picking unit universal joints, lubricate 10 fittings with two shots of grease with hand gun.
5. Picking unit input clutches, lubricate 2 fittings with two shots each of grease with hand gun.
6. Picker bars, lubricate fittings until grease appears at bearing caps.
7. Picker bars cams and cam rollers, lubricate 8 fittings with 89 ml. (3 fl. oz.) of grease minimum.
8. Drum slip clutches and idler gears, lubricate fittings with four shots of grease with a hand gun.
9. Unit coupling sprockets, lubricate 4 fittings with several shots of grease with a hand gun.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the importance of proper maintenance of the lubrication system of picker head.

2. Lubricate the picker head on the designated cotton picker.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, rags, lubricant, hand grease gun, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.4 **TASK:** Aligns bars.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, necessary tools and equipment, replacement parts,

EVALUATION: align picker bar on designated cotton picker.

STANDARD: Replace all worn parts, and align picker bars to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss shop safety procedures.

2. Disassemble and align picker bar.

3. Remove spindles from bar.

4. Remove roller from cam follower stud.

5. Remove spring on holding drive gear to shaft, using a pin punch.

6. Use GP-9907 Gear Puller to remove spindle drive shaft gear. Replace gear if badly worn or damaged.

   NOTE: If spindle drive shaft is to be removed from picker bar, drive gear may be removed after shaft is removed.

7. To remove spindle drive shaft, use SRP-9916 Snap Ring Pliers to remove snap ring from picker bar bore.

   NOTE: Leave snap ring loose on drive shaft.

8. Use a 5/8 in. (16 mm.) diameter rod to drive shaft out of picker bar.

   NOTE: If bar is bent, it may be necessary to straighten it before shaft can be removed.

9. Examine bearings, gears, and drive gear for wear or damage. Replace parts as needed.

10. Straighten bar, using rod and hook, until gauge pin can be inserted easily through hole in tailstock and into bar.

11. Remove plug and extra sleeve.

12. Install holder in stand and tighten set screw.

13. Position bar with busing in stand, on holder.

14. Place bore alignment gauge in bore, aligning keyway.

15. Place cam follower over gauge, aligning keyway and key.

    IMPORTANT: Make sure cam follower has been properly positioned for a right or left-hand picker bar before pressing.

16. Place cam follower driver over gauge. Press cam follower arm onto bar flush with top of stand.

17. Insert bore alignment gauge in the upper portion of picker bar. If gauge will not slide into bar the full length of gauge, size or ream inside of bar to manufacturer's specifications.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students disassemble and inspect picker bar.

2. Following a demonstration, have students repair as necessary and align picker bar.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, pin punch, GP-9907 Gear Puller, SRP-9916 Snap Ring Pliers, 5/8 inch diameter rod, cam follower, replacement parts, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.5 **TASK:** Replaces grid bars.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, instruction in shop safety, necessary equipment,

EVALUATION: replace grid bars on designated cotton picker.

STANDARD: Demonstrate safety practice. Replace grid bars so that the machine operates within manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss safety aspects of replacing grid bars.
2. Inspect grid bars to be sure they are straight and undamaged. Remove and straighten or replace as needed.
3. To remove front bars, remove screw, and loosen clamp bolt on the other end. Reverse to install bars.
4. To remove rear bars, loosen clamp bolts through support, and remove screw at other end. Reverse to install bars.
5. Adjust all bars to provide equal spacing between bars and spindles at the center of the bars.
6. Torque screws to 21-27 ft.-lbs.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the section on grid bars in the manufacturer's service manual.
2. Discuss the safety aspects of replacing gird bars.
3. With the help of the Student Learning Tasks and service manual, replace grid bars.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, necessary equipment, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.6 **TASK:** Replaces spindles and bushings.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, a spindle wrench, replacement parts,

EVALUATION: replace spindles and bushings on designated cotton picker.

STANDARD: Demonstrate how to replace spindles and bushings so that repaired spindles operate correctly. Spindles will be torqued to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss shop safety procedures.
2. Demonstrate the use of spindle wrench, disassemble spindles.
3. Place the spindle assembly, gear end down, in position in the head of repair kit.
4. Press on tip of spindle to force out of nut assembly and remove dust collar.
5. With spindle nut remaining in the head, press out both bushings together, using driver tool.

   NOTE: Do not mix parts from right and left-hand spindles, if they are to be reused.

6. Size new bushings before installing spindle nuts, to provide a hardened inner surface which will fit properly on a new spindle.

   NOTE: The preferred method of sizing the bushings is to use Bearingizer Driver BD-9912G, with RB-9911 Roller Bearingizers.

7. Check service manual for recommended tolerance.
8. Press broach, with arrow on broach pointing DOWN, through the bushings in the nut.
9. Reassemble spindles. Place block in the head, insert inboard bushing, spindle nut (thread DOWN), and outboard bushing over the aligning pin.
10. Position driver over pin. Press bushings into place, until shoulder of tool and inside edge of inboard bushing flange are against nut.

11. Place blocks in position of head, lubricate inside of nut with recommended spindle lubricant.

12. Slide spindle through nut, place collar on spindle, and set assembly in block.

13. Press collar onto spindle until driver bottoms on block.

14. The spindle must have a minimum of end play with the nut. Check service manual for recommended specifications, measure with leaftype feeler gauge.

15. To increase end play, add shims between blocks.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students remove and inspect spindles.

2. Following a demonstration, have students replace spindles and bushing on designated cotton picker.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, spindle wrench, driver tool, Bearingizer Driver BD-9912G, RB-9911 Roller Bearingizer, replacement parts, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

26.7 **TASK:** Reconditions picker bars.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, special equipment, and needed parts,

EVALUATION: recondition picker bars.

STANDARD: Demonstrate how to recondition picker bars so that repaired bar operates correctly. All work will be to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss shop safety procedures.
2. Disassemble picker bar. Replace parts as needed.
3. Straighten picker bar with cam follower.

   IMPORTANT: Install large spindle nuts in 3rd and 4th positions from top of bar. Nuts may be ordered from service parts.

4. Place bar in journal clamp, with spindle nuts between blocks. Tighten journal clamp, but leave spindle nut clamp loose.

   IMPORTANT: If journal sleeve is loose in clamp, install new sleeve before continuing.

5. Place adapter blocks beside cam follower arm body. Place block with deeper notch on arm side of body.
6. Tighten screws.
7. Use gauge pin to determine whether bar is bent. If pin will not slide easily through straightener tailstock into bar, without pressure on bar, straighten bar.
8. To bend bar down, use hook and rod.
9. To bend bar sideward, insert rod in base of straightener.
10. Check straightness with pin to allow pin to slide easily through tailstock into bar.

    NOTE: Leave pin in place for following steps.

11. Loosen journal clamp slightly, tighten spindle clamp bar screws, and tighten journal clamp.

    NOTE: Ribbed end of clamp bar must be on spindle nuts.

12. Install roller ring over cam follower stud.

13. Check cam follower position with gauge. If gauge slips easily over ring, the cam follower does NOT need straightening.

    NOTE: If gauge will not slip over ring before straightening bar, reverse gauge and check misalingment of stud-to-gauge shaft.

14. To determine direction and amount that arm must be bent, install ring on stud and position gauge next to ring.

    IMPORTANT: Install PBP-9922 Plug in picker bar journal before straightening arm or bar, to keep bar from collapsing. If plug cannot be inserted, size the bore. Never attempt to straighten the follower arm without the ring in place on the roller ring, as severe damage could result. Also, never use the cam follower gauge as a press block.

15. To straighten side-to-side, place cylinder in block and with ring on roller, use pump to bend arm.

16. To straighten upward, place cylinder on lower block and press against ring.

17. To straighten downward, place cylinder on upper block and press against arm.

18. Check cam follower position after each straightening operation, until acceptable straightness is obtained.

    NOTE: If picker bars can't be straightened uniformly or if the gauges won't fit on a straightened bar, it is usually due to an excessively worn picker bar bearing journal. Also, if journal area is bent or distorted, it may be necessary to remove the cam follower arm and use special straightening procedures, or size the picker bar bore. A Master Bar Gauge is available to check the components of the bar straightener for wear and straightness. GB-202 Gauge Bar may be used to check spindle spacing, to determine whether pick bar is bowed, after assembly of bar. Check accuracy of gauge bar periodically.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss shop safety procedures.
2. Following a demonstration, have students disassemble and inspect picker bar.
3. Following a demonstration, have students recondition picker bar to manufacturer's specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, special equipment, needed parts, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.8 **TASK:** Replaces bushings/studs of picker bars.

PERFORMANCE OBJECTIVE:

See Task 26.7.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.9 **TASK:** Adjusts level of picker bars.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, GT-9051R Planning Tool, Model III Dial Indicator, needed parts,

EVALUATION: adjust level of picker bars on designated cotton picker.

STANDARD: Adjust level of picker bars so that the machine operates within manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

ATTENTION: All spindles must pass under the doffer pads to within 0.20 mm. (0.008 in.) on same plane. If a bar exceeds these limits the spindles on that bar will not doff properly. If a picker bar is higher than the others, the spindles on that will cause excessive wear on the doffer pads when the doffer had been adjusted down to doff the other spindles.

1. Discuss the safety aspects of servicing/repairing picker bars.
2. Identify the causes of the need to adjust level of picker bars.
3. Remove tension from unit drive belts to allow the picker drum to be turned by manually rotating the doffer column.
4. Use fluid gauge (preferred) or dial indicator method to obtain accurate spindle planning.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss safety aspects of servicing/repairing picker bars.
2. Identify the causes of the need to adjust level of picker bars.
3. Following a demonstration, have students adjust level of picker bars to manufacturer's specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, GT-9051R Planning Tool, Model III Dial Indicator, needed parts and equipment, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.10 **TASK:** Installs sleeves of picker bars.

PERFORMANCE OBJECTIVE:

See Task 26.7.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.11 **TASK:** Replaces cam arms of picker bars.

PERFORMANCE OBJECTIVE:

See Task 26.7.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

26.0 COMPETENCY/SKILL: Services/repairs picking unit of cotton picker needed for agricultural operations.

26.12 TASK: Reconditions picker drum heads.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: service/repair the picker drum heads.

STANDARD: Demonstrate how to recondition picker drum heads so that repaired picker drum heads operate correctly. Torque to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing the picker drum heads.

2. Identify the causes of the need to recondition picker drum heads.

3. Remove picker drum.

4. Remove drum drive shaft and gears.

   IMPORTANT: When disassembling drum-head, drive-shaft, and sun-gear, do not mix picker drum parts. Tag or keep parts separated if more than one drum is being serviced.

5. Inspect bore in lower end of drum for wear. It must be 61.999-62.024 mm. (2.4409-2.4410 in.), to prevent drum wobble when running.

6. Remove snap ring, washer, bearing, and seal. Replace parts if worn or damaged.

7. If bearing surface of stud is worn or damaged, replace the stud. Diameter of bearings surface must be 29.982-30.008 mm. (1.1804-1.184 in.).

8. Use a socket or similar driver to press grease seal, lip of seal DOWN, onto stud until it seats on lower shoulder.

9. Press bearing on with the same driver, until it seats on upper shoulder of stud.

   IMPORTANT: Make sure there is clearance between seal and bearing, can rotate freely.

10. Install washer and snap ring.

11. Inspect drum shaft surfaces for wear or damage. The upper bearing surface diameter must be 31.67-31.72 mm. (1.247-1.249 in.); the lower bearing diameters must be 44.399-44.450 mm. (1.7480-1.7500 in.). Replace shaft if necessary.

12. Inspect drum head for cracks or excessive wear in the picker bar bearing area. If difference between a new sleeve O.D. and head bores (caps installed) I.D. is more than 0.64 mm. (0.025 in.), replace head.

13. Torque head-to-shaft screws to 115-142 N.m. (85-105 lb.-ft.).

14. Inspect sun gear, seals and bearings. Replace if worn or damaged. Pull or drive out seal and bearing together.

15. Inspect sun-gear-drive gear, drum drive gear, thrust washer, doffer drive sprocket and doffer drive chain. Replace as needed.

    IMPORTANT: Use JDG-154 Driver with 27489 Handle to press needle bearings into housing, manufacturer's I.D. number to outside. The driver positions the bearings 7.6 mm. (0.030 in.) into the bore.

16. Install seal (BOTTOM of housing only), with lip of seal toward bearing, outer surface flush with bottom of chamfer in bore.

17. Pack needle bearings and coat seal lips with recommended multipurpose lubricant, or equivalent.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the safety aspects of servicing/repairing the picker heads.
2. Identify the causes of the need to recondition picker drum heads.
3. Following a demonstration, have students inspect picker drum heads.
4. Following a demonstration, have students recondition picker drum heads.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

Service manual, mechanic's tool set, needed parts and equipment, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.13 **TASK:** Replaces grease tubes.

PERFORMANCE OBJECTIVE:

See Task 26.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.14 **TASK:** Replaces drum head.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace drum heads.

STANDARD: Demonstrate how to replace drum head so that drum head operates correctly. Torque to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing the picker drum heads.

2. Install picker drum and gears.

3. Coat teeth of sun gear with recommended multipurpose type lubricant.

4. Place sun gear housing and drive shaft, with head, in unit upper housing from below, and through doffer drive sprocket.

5. Slide picker drum under head and attach to head. Torque screws to 115-142 N.m. (85-105 lb.-ft.).

6. Apply recommended multipurpose-type grease to drum stud.

7. Install drum stud; torque screws to 34-41 N.m. (25-30 lb.-ft.).

8. Install thrust washer over drive shaft, and position next to doffer sprocket.

   IMPORTANT: Check position of sun gear housing on drive shaft, and be sure that needle bearings in housing bore have not shifted during shaft assembly. Correct if necessary to assure free rotation of shaft.

9. Lubricate surface of thrust washer with multipurpose type grease.

10. Coat teeth of sun-gear-drive gear with recommended multipurpose-type lubricant prior to installation.

11. Position thick spacer, sun-gear-drive gear, and thin spacer over shaft and thrust washer.

12. Align holes and secure with screws; torque screws to 34-41 N.m. (25-30 lb.-ft.).

13. Lubricate sun-gear grease fitting with 104 ml. (3.5 fl. oz.) of multipurpose-type grease.

14. Install and tighten doffer drive chain.

15. Coat teeth of drum drive gear with multipurpose-type lubricant.

16. Install special hardened washer on drive shaft, key and drive gear, long hub UP, and plain washer.

17. Install cover, torque screws to 27-41 N.m. (20-30 lb.-ft.).

18. Install bearing (flat side up), washer, and slotted nut. Torque nut to 163-203 N.m. (120-150 lb.-ft.) and install cotter pin.

19. Install bearing cap; torque screws to 27-41 N.m. (20-30 lb.-ft.).

20. Install lubrication line, insert line into fitting. Be sure to hold lubrication line firmly in fitting and hand tighten nut snug against fitting.

    IMPORTANT: Make sure the lubrication harness lines are not kinked or bent.

21. Install picker bars.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss safety aspects of servicing/repairing a cotton picker.

2. Following a demonstration, have students explain why it may be necessary to install an extra washer, if picker bars are running too high.

3. Following a demonstration, have students replace drum head on designated cotton picker.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.15 **TASK:** Replaces top drive gear of drum shaft.

PERFORMANCE OBJECTIVE:

See Task 26.12.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.16 **TASK:** Replaces sun gears of drum shaft.

PERFORMANCE OBJECTIVE:

See Task 26.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.17 **TASK:** Replaces idler gears and bearings.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: repair idler gears and bearings in picker unit.

STANDARD: Replace idler gear and bearings in drum of picker unit so that the unit operates within manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss safety procedures used when servicing/repairing picker unit.

2. Remove drum drive shaft.

3. Remove upper bearing assembly screws.

4. Lift gear and slip clutch assembly up out of the lower bearing housing, and remove from unit.

   IMPORTANT: Drive new bearing into housing with a driver which contacts only the O.D. of the bearing until bearing bottoms in bore.

5. Remove cam track, if it is necessary to remove the bearing housing.

   NOTE: Bearing may be removed with a puller without removing the housing. Replace bearing and/or housing if needed.

   IMPORTANT: Drive new bearing into housing with a driver which contacts only the O.D. of the bearing until bearing bottoms in bore.

6. Disassemble idler assembly by removing fitting, and nut from shaft. Pull the bearing, remaining parts will slide off the shaft.

   IMPORTANT: Observe slope of slip clutch jaws. Mark them (top and bottom) to assure assembling in the SAME location in the slip clutch assembly and in the SAME drum location in the unit.

7. Check drum idler gear for chipped or worn teeth. Examine interal bronze bushing for wear or damage. I.D. of a new bushing, install in gear, is 31.775-31.852 mm. (1.25551-1.254 in.). Replace as needed.

8. Examine sun-gear-idler gear teeth for wear or damage.

9. Check clutch jaw pin pockets for wear.

10. Inspect diameter of shaft in drum gear idler area. O.D. of new part is 31.669-31.725 mm. (1.2480-1.2490 in.). Replace shaft as required.

11. Replace upper bearing if worn or damaged by pressing against shoulder of shaft.

12. Inspect spring for damage. Free length should be 67.15 mm. (2.250 in.).

13. Replace upper bearing if worn or damaged by pressing against shoulder of shaft.

    IMPORTANT: Reverse procedure for reassembly. Be sure raised hub of washer contacts inner bearing race.

14. Torque lock nut to 102-136 N.m. (75-100 lb.-ft.), and install fitting.

15. Lubricate clutch through fitting with recommended multipurpose lubricant, or equivalent, until grease appears around jaws.

16. Place idler gear assembly in lower bearing and install upper bearing assembly and screws. Torque screws to 17-24 N.m. (12-18 lb.-ft.).

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss safety procedures used when servicing/repairing picker unit.

2. Following a demonstration, have students inspect idler gears and bearings.

3. Replace idler gears and bearings to manufacturer's specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.18 **TASK:** Reconditions doffer.

PREFORMANCE OBJECTIVE:

CONDITIONS: Given the manufacturer's service manual, needed replacement parts, mechanic's tool set, and equipment,

EVALUATION: recondition the doffer column on designated cotton picker.

STANDARD: All parts must be clean and must operate to manufacturer's specifications. Replacement parts should be installed where necessary.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper safety precautions.
2. Demonstrate how to remove doffer column according to directions in service manual for specific cotton picker.
3. Remove adjusting shaft assembly from picking unit.
4. Remove jam nut and thread adjusting screw down through housing.
5. Remove large retaining ring and pull stud shaft with bearing from screw bore.
6. Remove small ring from shaft and remove bearing sprocket, and seal.
7. Replace worn and damage parts.
8. Remove housing and nuts from shaft.
9. Examine housing and bearing for wear or damage. New bearings O.D. is 61.986-61.999 mm. (2.4404-2.4409 in.). New housing I.D. is 62.012-62.037 mm. (2.4414-2.4424 in.). Replace parts as needed.
10. Replace doffers when pads are damaged, or worn off.

    IMPORTANT: For efficient doffing of the spindles, it is necessary to have a doffer pad spacing of 41.28 mm. (1.625 in.), the same as the spindle spacing. This spacing must be held to an accumulated tolerance of 0.18 mm. (0.007 in.) for the entire length of the doffer assembly.

11. Assemble doffer column, using L3179N Shim between every third pad and spacer, not to exceed six shims total. Torque lock nut to 305 N.m. (225 lb.-ft.).

12. Check spacing of assembled column with GB-202 Gauge Bar. Adjust quanity and location of shims to reduce amount of grinding which will be required.

    NOTE: Check GB-202 Gauge Bar accuracy periodically, using MCG-9918 Moistener column gauge.

13. Lock doffer in G-9900 Doffer Grinder, using G-9924 Adapter. Move tailstock on grinder if necessary.

14. Check setting of rear stop and adjust if necessary to allow maximun travel of grinding disks without coming in contact with doffer pads.

15. Start grinder and turn feed wheel until a grinding disk just contacts the first doffer pad.

16. Turn micrometer stop against backup plate, then back it off slightly.

    NOTE: Check the largest spacing between a grinding disk and doffer pad. This is the minimum material which must be removed from the highest pad. To reduce the amount of grinding required, the shims may be adjusted. Mark the doffer pads to indicate the number of shims which would obtain the best spacing (least amount of grinding). Paint or chalk pad surface before grinding.

17. Rotate the feed wheel clockwise again until contact is made with micrometer stop. Repeat this operation until all grinding disks have made contact with the doffer pads. Discontinue grinding when marks are removed.

18. Stop the motors and check all doffer pads to make sure they have been ground. Check spacing. If necessary, repeat the grinding operation.

19. After the doffers have been ground, check the doffer shaft flange facing with a dial indicator for excessive run-out. The run-out must not exceed 0.0005 inch (0.0013 mm.), or the unit may vibrate and cause poor cotton doffing. If necessary, machine the facing flat by taking a minimal cut on the lathe.

    IMPORTANT: To assure proper checking and machining, check the doffer assembly in the lathe at the flange pilot and the shaft center. Install bottom plug after adjusting doffer.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss proper safety precautions when servicing/repairing picker unit.

2. Study the section on disassembly and reassembly of doffer column in the appropriate shop manual of manufacturer's service manual.

3. Service the doffer column on the designated cotton picker.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, needed replacement parts, mechanic's tool set, necessary equipment, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.19 **TASK:** Aligns doffer.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the manufacturer's service manual, needed replacement parts, mechanic's tool set, necessary equipment,

EVALUATION: align doffer on designated cotton picker.

STANDARD: Align doffer according to the manufacturer's instructions. All parts must be clean and must operate to manufacturer's specifications. Replacement parts should be installed where necessary.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper safety precautions.
2. Demonstrate how to align doffer according to directions in service manual for specific cotton picker.
3. Loosen upper housing bolts.
4. Remove two picker-bar-pivot-stud screws and install N191306 Radius Gauge, offset portion down. Tighten screws.
5. Hang N117835 Gauge (1.51 mm. [0.187 in.]) over top spindle.
6. Hang N117837 Gauge (4.75 mm. [0.187 in.]) over third spindle from the bottom.
7. Loosen doffer column bar lower bolts.
8. Rotate doffer column until gauges touch doffer. When doffer is against upper and lower gauges, with radius gauge against lower bearing housing, doffer is positioned correctly.
9. Torque bolts to 47-54 N.m. (35-40 lb.-ft).
10. Torque upper housing bolts to 47-54 N.m. (35-40 lb.-ft.).
11. If doffer binds after making previous adjustments, loosen top and botton bolts and shim any gaps. Retorque all bolts to 47-54 N.m. (35-40 lb.-ft.).
12. Recheck doffer height to see that pads "lightly touch" the spindles under the leading edge of the column.
13. Tighten drive chain.

14. If doffer binds after making previous adjustments, loosen top and bottom bolts and shim any gaps. Retorque all bolts to 47-54 N.m. (35-40 lb.-ft.).

15. Recheck doffer. A properly positioned doffer will have the following features:

    A. Doffer pads are parallel to top of spindles when spindles are fully under doffer.
    B. Doffer will be close or may touch top spindle collars and miss lower spindle collars up to 3 mm. (0.12 in.) maximun.
    C. Spindles touching doffer when they enter will clear when they leave.
    D. After aligning doffer, gap between doffer and spindle is permissible.

16. Recheck doffer height to see that pads "lightly touch" the spindles under the leading edge of the column.

17. Tighten drive chain.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss proper safety precautions when servicing/repairing picker unit.

2. Study the section on alignment of doffer column in the appropriate shop manual or manufacturer's service manual.

3. Align doffer on the designated cotton picker.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, special tools and equipment, replacement parts, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

26.0 **COMPETENCY/SKILL:** Services/repairs picking unit of cotton picker needed for agricultural operations.

26.20 **TASK:** Replaces drive chain.

PREFORMANCE OBJECTIVE:

CONDITIONS: Given the manufacturer's service manual, needed replacement parts, mechanic's tool set, and necessary equipment,

EVALUATION: replaced doffer drive chain on designated cotton picker.

STANDARD: Replace doffer drive chain following instructions. All parts must be clean and must operate to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper safety precautions.

2. Demonstrate how to replace drive chain according to directions in service manual for specific cotton picker.

3. Loosen nuts on drive chain adjusting rods on doffer being serviced.

4. Loosen nut.

5. Turn adjusting screw counterclockwise until stub shaft is fully raised off doffer column.

6. To replace doffer drive chain, remove cover, idler and drive gears.

7. Remove idler sprocket bolt, and remove chain.

   NOTE: An alternative method of removing the chain is to remove cotter pins and nuts from shaft, and outer nuts from tightener rod. Remove tightener assembly out with chain.

8. Install new chain or tightener components using reverse steps. Tighten chain to allow approximately 3 mm. (1/8 inch) free play in the doffer column.

   IMPORTANT: Align tightener sprocket with doffer driven sprocket by positioning shaft as required.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss proper safety precautions when servicing/repairing picker unit.

2. Study the section on servicing/repairing doffer drive chain in the appropriate shop manual or manufacturer's service manual.

3. Replace doffer drive chain on the designated cotton picker.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, necessary equipment, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

27.0 **COMPETENCY/SKILL:** Services/repairs water system of cotton picker needed for agricultrual operations.

27.1 **TASK:** Reconditions moistener column.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts,

EVALUATION: recondition moistener column on designated cotton picker.

STANDARD: Service and repair moistener column to manufacturer's instructions. The system must operate to manufacturer's specifications and no leakage should occur.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper safety precautions used when servicing/repairing the picking unit.
2. Recondition moistener column.
3. Remove screws to separate distributor from column.
4. Clean distributor, cover, and moistener lines throughly. Backflush lines if necessary.
5. Make a hooked wire to aid in replacing moistener pads.
6. Replace pads, using hooked wire, if fins are badly worn.

   NOTE: Fins of pad MUST be at right angles to pad stem when installed.
7. If pad is reused, clean holes by washing and air blasting.
8. Inspect plastic tubes in moistener column for splits, kinks, or other damage. Replace as needed.
9. Remove damaged tubes and insert new tube through head and pad holder.
10. Pull tube through head to remove slack, and cut to 13 mm. (1/2 inch) above head.
11. Using a low heat flame, flare end of tube.
12. After cooling, pull tube into head, flared end flush with head surface, so it will not interfere with distributor when installed. If necessary, trim off any excess material.

13. Place moistener column in MCG-9918 Gauge to check pad holder alignment and spacing. Lock column in place (gauge T-handles horizontal) and push holders against gauge pads.

14. Check space between holder and gauge pad with a leaftype gauge. If space is more than 0.15 mm. (0.060 inch), mark and straighten holder.

15. Clamp column in vise, use PS-9919 straightener to straighten holders.

16. Repeat as necessary to correct alignment.

NOTE: If necessary to replace a pad holder, tackweld holder in place, and use moistener column gauge to position holder before welding in place.

17. Install distributor. ALIGN HOLES IN DISTRIBUTOR AND HEAD. Torque bolts to 14 N.m. (10 lb.-ft.).

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss proper safety precaution used when servicing/repairing the picking unit of the cotton picker.

2. Following a demonstration, have students inspect moistener column and discuss reasons for the necessity to recondition moistener column.

3. Following a demonstration, using a service manual have students recondition moistener column to manufacturer's specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

27.0 **COMPETENCY/SKILL:** Services/repairs water system of cotton picker needed for agricultrual operations.

27.2 **TASK:** Sets moistener columns.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, and necessary equipment,

EVALUATION: adjust moistener columns vertically and horizontally.

STANDARD: Set moistener columns according to service manual instructions. Cotton picker moistener columns must operate within manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing the picking unit.
2. Set moistener columns.
3. Adjust moistener column vertically.
4. Loosen lock nuts.
5. Turn adjusting screw clockwise to lower column until pads just wipe spindles.
6. Tighten lock nuts, unless horizontal alignment is needed.
7. Adjust moistener column horizontally.
8. Turn adjusting screw counterclockwise to loosen column.
9. Loosen three bolts in bolting ring.
10. Loosen two bolts in column base.
11. Shift column so entire length of spindle is wiped by moistener pad. Rotate drum manually, using a wrench on the doffer hex shaft.
12. Check clearance and repeat as necessary. Tighten bolts in ring and base.
13. Adjust moistener column vertically if alignment is needed.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss proper safety aspects of servicing/repairing picker unit of the cotton picker.
2. Following a demonstration, have students inspect moistener column and discuss reasons for the necessity of proper alignment.
3. Following a demonstration, using a service manual have students set moistener columns to manufacturer's specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, necessary equipment, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

27.0 **COMPETENCY/SKILL:** Services/repairs water system of cotton picker needed for agricultrual operations.

27.3 **TASK:** Rebuilds water pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts,

EVALUATION: rebuild water pump on designated cotton picker.

STANDARD: Rebuild water pump following manufacturer's instructions. The water pump must operate to manufacturer's specifications and no leakage should occur.

STUDENT LEARNING EXPERIENCES:

1. Discuss the use of proper precaution when servicing/repairing the cotton picker.
2. Rebuild water pump.
3. Drain strainer by removing lid, and pump by opening bleed cock.
4. Loosen bracket bolts, and remove mounting bolts.
5. Loosen set screw.
6. Remove set screw and remove sheave.
7. Remove strainer assembly.
8. Remove screws, cover, and gasket.

   NOTE: Install new gasket. If screws are replaced, use brass screws.
9. With shaft held securely, unscrew impeller and remove shims.
10. Remove clamp screw. Remove pump body from pedestal.
11. Press seal out of pump body.
12. Replace seal. Apply a thin coat of Permatex No. 3 to seal casing prior to installation.
13. Remove snap ring.
14. Press shaft and bearing assembly out of pedestal using a driver which contacts the shaft bearing shoulder.
15. Examine and replace parts as required.

16. Press shaft and bearing assembly into housing using a driver which contacts shaft bearing shoulder. Install snap ring.

17. Turning body back and forth on pedestal, return body to its original position. Tighten clamp screw.

18. Thread impeller on shaft until it bottoms on shaft shoulder.

19. Rotate shaft to check clearance. If impeller does not turn or if there is interference, add the necessary shims between shaft and shoulder.

20. Install a new gasket, cover, and six screws.

21. Install pump, align sheaves, and tighten belt to 67-85 N. (15-19 lb.) static tension. Use pipe thread sealant on pipe threads.

    IMPORTANT: Do not force sheave on to pump shaft. Sheave should slide on freely to prevent possible damage to pump seals and bearings.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the use of proper precaution when servicing/repairing the cotton picker.

2. Following a demonstration, have students inspect water pump and discuss reasons for the necessity to rebuild water pump.

3. Following a demonstration, using a service manual have students rebuild water pump to manufacturer's specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

27.0 **COMPETENCY/SKILL:** Services/repairs water system of cotton picker needed for agricultrual operations.

27.4 **TASK:** Replaces water pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, replacement water pump,

EVALUATION: replace water pump on designated cotton picker.

STANDARD: Replace water pump following manufacturer's instructions. The water pump must operate to manufacturer's specifications and no leakage should occur.

STUDENT LEARNING EXPERIENCES:

1. Discuss the use of proper precaution when servicing/repairing the cotton picker.
2. Replace water pump.
3. Drain strainer by removing lid, and pump by opening bleed cock.
4. Loosen bracket bolts, and remove mounting bolts.
5. Loosen set screw.
6. Remove set screw and remove sheave.
7. Remove strainer assembly.
8. Remove defective water pump.
9. Install pump, align sheaves, and tighten belt to 67-85 N. (15-19 lb.) static tension. Use pipe thread sealant on pipe thread.

   IMPORTANT: Do not force sheave on to pump shaft. Sheave should slide on freely to prevent possible damage to pump seats and bearings.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the use of proper precaution when servicing/repairing the cotton picker.

2. Following a demonstration, have students inspect water pump and discuss reasons for the need to replace water pump.

3. Following a demonstration, using a service manual have students replace water pump to manufacturer's specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement water pump, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

27.0 **COMPETENCY/SKILL:** Services/repairs water system of cotton picker needed for agricultrual operations.

27.5 **TASK:** Installs water pump restraint kit.

PERFORMANCE OBJECTIVE:

See Task 27.4.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

27.0 **COMPETENCY/SKILL:** Services/repairs water system of cotton picker needed for agricultrual operations.

27.6 **TASK:** Reconditions pressure plates.

PERFORMANCE OBJECTIVE:

See Task 27.8.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

27.0 **COMPETENCY/SKILL:** Services/repairs water system of cotton picker needed for agricultrual operations.

27.7 **TASK:** Replaces flaps on pressure plates.

PERFORMANCE OBJECTIVE:

See Task 27.8.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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27.0 **COMPETENCY/SKILL:** Services/repairs water system of cotton picker needed for agricultrual operations.

27.8 **TASK:** Replaces pressure plates.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace pressure plates.

STANDARD: Replace pressure plates so that the cotton picker operates within manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the use of proper safety precaution when servicing/repairing a cotton picker.
2. Replace pressure plates.
3. Examine pressure plates, extensions, pressure shafts, and springs. Replace worn or damaged parts.

   CAUTION: Carefully release spring tensions with a wrench when removing lock screw.
4. Remove screw and release spring tension SLOWLY with wrench.
5. Remove spring locking pin, and remove links.
6. To replace pressure rod, remove snap rings from two pivot pins, remove springs and pins, lift out pressure plate, and remove rod.
7. To place springs, remove attaching bolt, raise adjusting pipe, and slide spring off.
8. Repair or replace pressure plates.
9. Adjust pressure plate tension by turning pressure pipe as required. Install upper bolt into next closest position.
10. Adjust each pressure plate to (3-6 mm.) 1/8 to 1/4 in. from spindle tips.

    NOTE: Repair/replace rear plates in a similar manner.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the use of proper safety precaution when servicing the cotton picker.

2. Identify the causes of the need to Services/repairs pressure plates.

3. Following a demonstration, have students replace pressure plates on designated cotton picker.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

28.0 **COMPETENCY/SKILL:** Services/repairs air system of cotton picker needed for agricultural operations.

28.1 **TASK:** Replaces air ducts.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a mechanic's tool set, service manual, replacement air ducts,

EVALUATION: replace air ducts on designated cotton picker.

STANDARD: Air ducts setting must be in accordance with specifications in service manual. There must be no damage to adjoining parts.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of replacing air ducts in a cotton picker.
2. Identify the causes of the need to replace an air duct.
3. List the steps in troubleshooting an air duct.
4. Discuss the procedures outlined in service manual for replacing an air duct.
5. Demonstrate how to replace an air duct.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students inspect air ducts.
2. Following a demonstration, have students troubleshoot air ducts.
3. Following a demonstration, have students replace air ducts on designated cotton picker.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement air ducts, and cotton picker.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

28.0 **COMPETENCY/SKILL:** Services/repairs air system of cotton picker needed for agricultural operations.

28.2 **TASK:** Replaces blower fan belt.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts,

EVALUATION: replace blower fan belt.

STANDARD: Replace blower fan belt following manufacturer's instructions. All parts must be clean and must operate to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the use of proper safety precaution when servicing/repairing a cotton picker.
2. Replace blower fan belt.
3. Remove nuts from throwout rod, and remove belt.

   IMPORTANT: The three fan sheaves MUST be aligned. If necessary, move fan housing to improve alignment. Check alignment whenever a new belt is installed.

4. Install new belt.
5. Loosen fan housing bolts and align upper sheave with lower sheave.

   NOTE: If tightener sheave is not aligned with belt, remove yoke picot pin and move washers from one side of yoke to the other to improve alignment.

6. Set new blower fan belt.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss proper safety precautions when servicing/repairing a cotton picker.
2. Study the chapter on servicing/repairing the air system in the appropriate shop manual or manufacturer's service manual.
3. Replace blow fan belt on the designated cotton picker.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service, manual, mechanic's tool set, needed parts, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

29.0 **COMPETENCY/SKILL:** Services/repairs unit drive of cotton picker needed for agricultural operations.

29.1 **TASK:** Replaces belts.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given the manufacturer's service manual, replacement belts, mechanic's tool set,

EVALUATION: replace unit drive belts on designated cotton picker.

STANDARD: Replace unit drive belts following manufacturer's instructions. All parts must be clean and must operate to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss proper safety precautions.
2. Demonstrate how to replace unit drive belts.
3. Turn adjusting nut counterclockwise to loosen nut. Replace belts.
4. Turn adjusting nut clockwise to tighten. Tighten to 1068-1245 N. (240-280 lb.) static tension.

   NOTE: Check belts daily during run-in period. Tighten as necessary to prevent slippage.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss safety aspects of servicing/repairing unit drive belts.
2. Following a demonstration, have students explain why it is necessary to check belts daily during run-in period.
3. Following a demonstration, have students replace unit drive belts on designated cotton picker.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement belts, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

29.0 **COMPETENCY/SKILL:** Services/repairs unit drive of cotton picker needed for agricultural operations.

29.2 **TASK:** Replaces counter shaft.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace countershaft on designated cotton picker.

STANDARD: Replace unit drive countershaft, inspect parts for wear or damage, replace as necessary. Unit drive must operate within manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate the safety aspects of servicing/repairing the unit drive.
2. Replace unit drive countershaft.
3. Remove nuts (both ends) and screws, and remove slip clutch assembly.
4. Inspect shaft, bearings, slip clutch components, sheave, and belts for wear or damage.
5. Replace parts as necessary.
6. Reassemble and reinstall unit drive countershaft.

NOTE: If bearings are replaced, observe timing for lube line connection. Torque shaft nuts to (136-163 N.m.) 100-120 lb.-ft.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the safety aspects of servicing/repairing picker unit of the cotton picker.

2. Following a demonstration, have students disassemble and inspect unit drive countershaft.

3. Following a demonstration, have students repair as necessary and replace countershaft to manufacturer's specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement countershaft, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

29.0 **COMPETENCY/SKILL:** Services/repairs unit drive of cotton picker needed for agricultural operations.

29.3 **TASK:** Replaces U-joints.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts,

EVALUATION: replact U-joints on designated cotton picker.

STANDARD: Replace U-joints following service manual instructions. Machine must operate within manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing the unit drive.
2. Replace U-joint.
3. Remove screws, and remove output hub assembly.
4. Remove screws, and remove shield support and cross shaft hub assembly.

   NOTE: Retain any shims between hubs and case with each hub for use during assembly.

5. Remove slotted nut, pull U-joint and shaft from input shaft, and remove key.
6. Replace U-joint and reassemble.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the safety aspects of servicing/repairing picker unit of the cotton picker.
2. Following a demonstration, have students inspect U-joints and discuss reasons for replacing necessary parts.
3. Following a demonstration, using service manual have students replace U-joints to manufacturer's specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, and cotton picker.

RESOURCES:

9940 COTTON PICKER TECHNICAL MANUAL T M 1356. John Deere and Company, Moline, IL. 1985.

30.0 **COMPETENCY/SKILL:** Services/repairs cabinet of cotton picker needed for agricultural operations.

30.1 **TASK:** Replaces wear clamps.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a mechanic's tool set, service manual, needed parts and equipment,

EVALUATION: replace wear clamps.

STANDARD: Replaced wear clamps must be installed in accordance with manufacturer's specifications. There must be no damage to adjoining parts.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a cotton picker.
2. Identify the causes of the need to replace wear clamps.
3. List the steps in troubleshooting a picker cabinet.
4. Discuss the procedures outlined in service manuals for replacing wear clamps.
5. Demonstrate how to replace wear clamps.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students inspect wear clamps.
2. Following a demonstration, have students replace wear clamps on designated cotton picker.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and cotton picker.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

30.0 **COMPETENCY/SKILL:** Services/repairs cabinet of cotton picker needed for agricultural operations.

30.2 **TASK:** Hardsurfaces skid plates.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a mechanic's tool set, service manual, needed parts and equipment,

EVALUATION: hardsurface skid plates on designated cotton picker.

STANDARD: The hardsurface skid plates must be in compliance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a cotton picker.
2. Identify the causes of the need to hardsurface skid plates.
3. List the steps in troubleshooting a picker cabinet.
4. Discuss the procedures outlined in service manuals to hardsurface skid plates.
5. Demonstrate how to hardsurface skid plates.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students troubleshoot picker cabinet.
2. Following a demonstration, have students hardsurface skid plates on designated cotton picker.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and cotton picker.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

30.0 **COMPETENCY/SKILL:** Services/repairs cabinet of cotton picker needed for agricultural operations.

30.3 **TASK:** Reconditions stall lifters.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a mechanic's tool set, service manual, needed parts and equipment,

EVALUATION: recondition stall lifters.

STANDARD: Reconditioned stall lifters must operate in accordance with manufacturer's specifications. There must be no damage to adjoining parts.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a cotton picker.
2. Identify the causes of the need to recondition stall lifters.
3. List the steps in troubleshooting stall lifters.
4. Discuss the procedures outlined in service manuals for reconditioning stall lifters.
5. Demonstrate how to recondition stall lifters.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students inspect stall lifters.
2. Following a demonstration, have students troubleshoot picker cabinet.
3. Following a demonstration, have students recondition stall lifters on designated cotton picker.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and cotton picker.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

30.0 **COMPETENCY/SKILL:** Services/repairs cabinet of cotton picker needed for agricultural operations.

30.4 **TASK:** Replaces seals and bearings.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace seals and bearings.

STANDARD: Replaced seals and bearings must be installed in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a cotton picker.
2. Identify the causes of the need to replace seals and bearings.
3. List the steps in troubleshooting seals and bearings.
4. Discuss the procedures outlined in service manuals for replacing seals and bearings.
5. Demonstrate how to replace seals and bearings.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students inspect seals and bearings.
2. Following a demonstration, have students troubleshoot picker cabinet.
3. Following a demonstration, have students replace seals and bearings on designated cotton picker.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts and equipment, and cotton picker.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

30.0 **COMPETENCY/SKILL:** Services/repairs cabinet of cotton picker needed for agricultural operations.

30.5 **TASK:** Adjusts head.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: adjust head on designated cabinet of cotton picker.

STANDARD: When adjusted, cotton picker head unit must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of adjusting the picker head.
2. Identify the causes of the need to adjust the picker head.
3. List the steps in troubleshooting the picker head adjustment.
4. Discuss the procedures outlined in service manuals for adjusting picker head.
5. Demonstrate how to adjust the picker head for operations.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students troubleshoot picker head adjustment.
2. Following a demonstration, have students adjust the picker head on designated cotton picker.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and cotton picker.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

31.0 **COMPETENCY/SKILL:** Services/repairs combines for agricultural operations.

31.1 **TASK:** Attaches head (grain or corn).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a mechanic's tool set, replacement head, operator's manual, and necessary equipment.

EVALUATION: replace grain or corn head on designated combine.

STANDARD: All hoses, belts, and chains must be adjusted and head must operate according to manufacturer's specifications, with no damage to grain.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of replacing a head on a combine.
2. Identify the causes of the need to replace a grain or corn head.
3. List the steps in troubleshooting a grain or corn head.
4. Discuss the procedures outlined in service manuals for replacing a grain or corn head.
5. Demonstrate how to adjust head for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students remove and inspect a grain or corn head.
2. Following a demonstration, have students troubleshoot a grain or corn head.
3. Following a demonstration, have students install and adjust a grain or corn head.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operator's manual, mechanic's tool set, replacement head, necessary equipment, and combine.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

31.0 **COMPETENCY/SKILL:** Services/repairs combines for agricultural operations.

31.2 **TASK:** Replaces/adjusts cylinder (rotor).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, pullers, clyinder, and equipment,

EVALUATION: replace cylinder on a combine.

STANDARD: The replacement must be completed in accordance with manufacturer's specifications. Cylinder must be level and without side play.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of replacing a cylinder on a combine.
2. Identify the causes of the need to replace a cylinder.
3. List the steps in troubleshooting a cylinder on a combine.
4. Discuss the procedures outlined in service manuals for replacing a cylinder on a combine.
5. Demonstrate how to adjust cylinder for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students remove and inspect a cylinder on a combine.
2. Following a demonstration, have students troubleshoot a cylinder on a combine.
3. Following a demonstration, have students install and adjust a cylinder.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, pullers, replacement cylinder, and equipment.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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31.0 **COMPETENCY/SKILL:** Services/repairs combines for agricultural operations.

31.3 **TASK:** Replaces rasp bars.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace rasp bars on designated combine.

STANDARD: Rasp bars must be equally adjusted on both sides of the machine. Rasp bar setting must be in accordance with manufacturer's specifications. There must be no damage to adjoining parts.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of replacing rasp bars in a combine.
2. Identify the causes of the need to replace a rasp bar.
3. List the steps in troubleshooting a rasp bar.
4. Discuss the procedures outlined in service manuals for replacing rasp bars.
5. Remove and replace rasp bars.
6. Adjust the rasp bars for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students remove and inspect a rasp bar.
2. Following a demonstration, have students troubleshoot rasp bars.
3. Following a demonstration, have students install and adjust a rasp bar on designated combine.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and combine.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

31.0 **COMPETENCY/SKILL:** Services/repairs combines for agricultural operations.

31.4 **TASK:** Replaces beater.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace beater on designated combine.

STANDARD: The beater must be equally adjusted on both sides of the machine. Beater setting must be in accordance with manufacturer's specifications. There must be no damage to adjoining parts.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of replacing beater in a combine.
2. Identify the causes of the need to replace a beater.
3. List the steps in troubleshooting a beater.
4. Discuss the procedures outlined in service manuals for replacing a beater.
5. Remove and replace a beater.
6. Adjust a beater for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students remove and inspect a beater.
2. Following a demonstration, have students troubleshoot a beater.
3. Following a demonstration, have students install and adjust a beater on designated combine.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and combine.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

31.0 **COMPETENCY/SKILL:** Services/repairs combines for agricultural operations.

31.5 **TASK:** Replaces rear cross auger.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace rear cross auger on designated combine.

STANDARD: The cross auger must be installed and adjusted in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of replacing the rear cross auger on a combine.
2. Identify the causes of the need to replace a rear cross auger.
3. List the steps in troubleshooting an auger.
4. Discuss the procedures outlined in service manuals for replacing augers.
5. Remove and replace the rear cross auger.
6. Adjust the rear cross auger for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students remove and inspect a rear cross auger.
2. Following a demonstration, have students troubleshoot a rear cross auger.
3. Following a demonstration, have students replace a rear cross auger on designated combine.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts and equipment, and combine.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

31.0 **COMPETENCY/SKILL:** Services/repairs combines for agricultural operations.

31.6 **TASK:** Replaces auger drive countershaft.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace auger drive countershaft on designated combine.

STANDARD: The auger drive countershaft must operate to manufacturer's specifications. There must be no damage to adjoining parts.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a combine.
2. Identify the causes of the need to replace an auger drive countershaft.
3. List the steps in troubleshooting the auger drive countershaft.
4. Discuss the procedures outlined in service manuals for replacing auger drive countershaft.
5. Remove and replace the auger drive countershaft.
6. Adjust the auger drive countershaft for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students remove and inspect an auger drive countershaft.
2. Following a demonstration, have students troubleshoot auger drive countershaft.
3. Following a demonstration, have students install and adjust the auger drive countershaft on designated combine.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and combine.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

31.0 **COMPETENCY/SKILL:** Services/repairs combines for agricultural operations.

31.7 **TASK:** Replaces auger drive bearings.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: replace auger drive bearings on designated combine.

STANDARD: Auger drive must operate in accordance with manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of replacing auger drive bearings on a combine.
2. Identify the causes of the need to replace an auger drive bearings.
3. List the steps in troubleshooting auger drive bearings.
4. Discuss the procedures outlined in service manuals for replacing auger drive bearings.
5. Replace auger drive bearings for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students troubleshoot auger drive bearings.
2. Following a demonstration, have students replace auger drive bearings on designated combine.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, replacement parts, equipment, and combine.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

31.0 **COMPETENCY/SKILL:** Services/repairs combines for agricultural operations.

31.8 **TASK:** Tightens cable on loading auger.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set,

EVALUATION: Tighten cable on loading auger on designated combine.

STANDARD: Tightened cable on loading auger must be in accordance with manufacturer's specifications. Loading auger must operate without damage to grain.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing a combine.
2. Identify the causes of the need to tighten cable on loading auger.
3. List the steps in troubleshooting a loading auger.
4. Discuss the procedures outlined in service manuals for tightening cable on loading auger.
5. Demonstrate how to tighten cable on loading auger for proper operation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students troubleshoot the auger.
2. Following a demonstration, have students tighten cable on loading auger.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, and combine.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

31.0 **COMPETENCY/SKILL:** Services/repairs combines for agricultural operations.

31.9 **TASK:** Sets up platform.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manual, mechanic's tool set, needed parts and equipment,

EVALUATION: set up cutting platform on designated combine.

STANDARD: Cutting platform must operate in accordance with manufacturer's specifications. There must be no damage to adjoining parts.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects of servicing/repairing cutting platform.
2. Identify the causes of the need for cutting height adjustments, reel adjustments, auger adjustments, and ground speed adjustments.
3. Discuss the procedures outlined in service manuals for setting up cutting platform.
4. Set up cutting platform.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students inspect cutting platform.
2. Following a demonstration, have students set up cutting platform on designated combine.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, mechanic's tool set, needed parts and equipment, and combine.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

32.0 **COMPETENCY/SKILL:** Practices personal and human relations skills. (For all of Competency/Skill 32.0, see Agriculture Business and Management Competency/Skill 7.0)

32.1 **TASK:** Makes decisions when necessary.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a situation with several available alternative solutions,

EVALUATION: select the most suitable solution in light of the particular situation.

STANDARD: The selected outcome should include an implicit favorite model of decision-making.

STUDENT LEARNING EXPERIENCES:

1. Set goal.
2. Identify implicit favorite.
3. Compare and rank implicitly rejected alternatives.
4. Identify confirmation candidate.
5. Establish decision rule or criterion.
6. Announce decision.
7. Act.
8. Discuss process you used and why selected alternatives.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss with students on the various models of the decision-making process. (Econologic Model, Bounded Rationality Model, and Implicit Favorite Model.)
2. Participate in role-playing, given a set of various situations.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Textbooks, magazines, business journals, and media articles.

RESOURCES:

Steers, Richard M. INTRODUCTION TO ORGANIZATIONAL BEHAVIOR. Scott, Foresman and Company, Glenview, IL. 1981.

32.0 **COMPETENCY/SKILL:** Practices personal and human relations skills.

32.2 **TASK:** Listens well.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a situation whereby the student is given a verbal set of instructions,

EVALUATION: have the student write instructions on paper, and read instructions back to instructor.

STANDARD: Repeat accurately instructions received.

STUDENT LEARNING EXPERIENCES:

The following sample is one method which can easily and effectively be applied to listening:

Before Listening:

1. Motivation. Remind oneself of the importance of what will be communicated and how it will apply to the situation.
2. Learn about the speaker prior to and during the discussion.
3. Anticipate what will be discussed and focus your thoughts accordingly.

During the Listening Process:

1. Pay attention, filter internal or external distractions.
2. Maintain emotional balance. Attempt to not allow oneself to become excited or overly involved.
3. Organize the subject statements into main points and supportive subpoints.
4. Analyze and summarize what is being said.
5. Differentiate between relevant and irrelevant statements.

After Listening:

1. Ask pertinent questions reflecting back the communications.
2. Review the major and minor points being communicated.
3. Restate the major and minor points being communicated.
4. Attempt to categorize the information for a more complete understanding.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Listen to tape presentations and then identify the main points of the presentation.
2. Present the students with a set of verbal instructions and have students read back the instructions.
3. Invite a guest speaker to the class and have the students give oral and written critiques.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Tape recorders, pen, pencils, and paper.

RESOURCES:

Steers, Richard M. INTRODUCTION TO ORGANIZATIONAL BEHAVIOR. Scott, Foresman and Company, Glenview, IL. 1981.

32.0 **COMPETENCY/SKILL:** Practices personal and human relations skills.

32.3 **TASK:** Gets along with people.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a hypothetical work situation, i.e. a salesman for an agricultural chemical firm making a sales call,

EVALUATION: demonstrate ability to get along with others.

STANDARD: The individual should behave in accordance with recognized human relation standards, i.e. be courteous, attentive, etc.

STUDENT LEARNING EXPERIENCES:

1. Name 4 of the basic human motives that affect employer-employee relationships.

2. Cite a situation in which the "ability to get along with others" helped achieve a goal.

3. Discuss the statement: "More jobs are lost through the lack of personal relations skills than the lack of technical competency."

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Consult references to read more about human relation skills and getting along with others.

2. Bring in a magazine or newspaper article which demonstrates the importance of human relation skills in business.

3. Fill out evaluation form on page HO-4 in the reference cited below.

INSTRUCTIONAL EQUIPMENT, MATERIALS AND SUPPLIES:

1. Office setting furniture: desk and 2 chairs.

RESOURCES:

"Resource Unit on Human Relations," Agricultural Education Section. Department of Vocational Education, Phoenix, AZ and Department of Agricultural Education, The University of Arizona, Tucson, AZ. pp. 1-6. 1971. (classic text)

32.4 **TASK:** Communicates effectively.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a situation which requires the issuing of both written and verbal orders,

EVALUATION: correctly and efficiently communicate the assignment to others.

STANDARD: Both the written and oral communications must be clear and concise and the assignment must be correctly completed. The completed assignment must demonstrate the ability to effectively follow and issue instructions. (See Task 7.5)

STUDENT LEARNING EXPERIENCES:

1. Discuss the essentials of effective oral and written communication.
2. Name 4 goals of a business memo.
3. Discuss the barriers to effective communication and how they can be overcome.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Consult the references to discover more about effective business communication.
2. Role play in a communication exercise, i.e. issue instructions to a "lead" student who is then to write memos to several classmates in order to communicate a task to them. (The task can be a simple reordering of the classroom furniture). (See Task 7.5. Follow and provide instructions.)

INSTRUCTIONAL EQUIPMENT, MATERIALS AND SUPPLIES:

1. Memo forms, pen and/or typewriter.

RESOURCES:

Allen, J. and B.P. Lientz. EFFECTIVE BUSINESS COMMUNICATION-A PRACTICAL GUIDE. Goodyear Publishing Co., Santa Monica, CA. pp. 84-101. 1979.

32.0 **COMPETENCY/SKILL:** Practices personal and human relations skills.

32.5 **TASK:** Follows and provides instructions.

PERFORMANCE OBJECTIVE:

See Task 7.4.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS AND SUPPLIES:

RESOURCES:

32.0 **COMPETENCY/SKILL:** Practices personal and human relations skills.

32.6 **TASK:** Works irregular hours occasionally.

PERFORMANCE OBJECTIVE:

See Task 7.14.

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS AND SUPPLIES:

RESOURCES:

32.7 **TASK:** Develops self-confidence.

PERFORMANCE OBJECTIVE:

CONDITIONS: In the context of an imaginary agribusiness, institute a program which will,

EVALUATION: develop self-confidence.

STANDARD: The program developed must be tailored to the individual, it must identify job fears and ways of dealing with them.

STUDENT LEARNING EXPERIENCES:

1. Discuss three common job fears.
2. Identify five behaviors which demonstrate self-confidence, i.e the ability to effectively address an audience.
3. Discuss the statement: "Action cures fear."

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Give a speech about a topic of their choice; evaluate their confidence level.
2. Read the reference material in regard to self-confidence.

INSTRUCTIONAL EQUIPMENT, MATERIALS AND SUPPLIES:

1. Speakers podium.

RESOURCES:

Swartz, D.J. THE MAGIC OF THINKING BIG. Prentice-Hall, Inc., New York, NY. 1985.

32.0 **COMPETENCY/SKILL:** Practices personal and human relations skills.

32.8 **TASK:** Cooperates with fellow workers.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a situation in a simulated work setting involving a group or team of students,

EVALUATION: the students should demonstrate the ability to cooperate with each other in order to complete an assignment.

STANDARD: The assignment should be accurately completed with minimal confusion.

STUDENT LEARNING EXPERIENCES:

1. Cite two practical examples where cooperation is necessary in an agribusiness.
2. Discuss the barriers to cooperation which exist in almost any group activity, (i.e. personal differences, egos, lack of interpersonal skills).
3. Describe a work or personal experience you have had which demonstrates the value of cooperation.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read references in regard to cooperation.
2. Write about an experience they have had which demonstrates the value of cooperation.

INSTRUCTIONAL EQUIPMENT, MATERIALS AND SUPPLIES:

1. Office setting furniture: desk and 2 chairs.

RESOURCES:

"Resource Unit on Human Relations," Agricultural Education Section. Department of Vocational Education, Phoenix, AZ. and Department of Agricultural Education, The University of Arizona, Tucson, AZ. Section HO-13. 1971. (classic text)

32.9 **TASK:** Delegates responsibility when necessary.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a hypothetical situation in which an agribusiness manager has a list of tasks which he alone cannot accomplish and a group of subordinates of varying levels and types of expertise,

EVALUATION: properly delegate the tasks according to the abilities of your subordinates.

STANDARD: The manager must assign the tasks according to the abilities of the subordinates

STUDENT LEARNING EXPERIENCES:

1. Explain the essentials of delegation.
2. Discuss the concerns that many managers have about delegation.
3. Suggest the key steps involved in planning and delegating work effectively.
4. Highlight barriers to sound delegation and suggest practical ways of overcoming them.
5. Identify, in general, those tasks which can and cannot be delegated.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Provide students with job descriptions, i.e. engineer, secretary, receptionist, production worker; and tasks which need to be accomplished in a typical working day in an agribusiness, i.e. greeting a new employee, making a bank deposit, picking up a visitor from the airport, reviewing blueprints for a new installation, reading the daily mail, etc. Have them determine which tasks should be delegated and why.

2. Read the reference on delegation.

INSTRUCTIONAL EQUIPMENT, MATERIALS AND SUPPLIES:

1. A brief list of job descriptions: manager, secretary, production worker, etc. If none are readily available then the teacher may fabricate the descriptions in an oral description.

RESOURCES:

Seymour-Smith, L. DELEGATING EFFECTIVELY: A MANAGER'S GUIDE. Management Update Press, London, ENG. 1985.

32.0 COMPETENCY/SKILL: Practices personal and human relations skills.

32.10 TASK: Promotes (sell) yourself and your firm.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a simulated sales situation,

EVALUATION: promote yourself and your firm.

STANDARD: The individual must create a good impression and recognize that he is a reflection of his firm.

STUDENT LEARNING EXPERIENCES:

1. Name 3 attributes of the successful salesperson.
2. Discuss the statement: "Everyone working for an organization is, in one way or another, a salesperson."
3. Emphasize the importance of personal appearance in promoting oneself.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Consult references to discover more about selling and promotion of self and firm.
2. Bring to class articles about persons who are successful in promoting themselves and their respective firms.

INSTRUCTIONAL EQUIPMENT, MATERIALS AND SUPPLIES:

1. Office setting furniture: desk and 2 chairs.

RESOURCES:

"Resource Unit 6: Salesmanship and Selling," Agricultural Education Section. Department of Vocational Education Phoenix, AZ., and Department of Agricultural Education, The University of Arizona, Tucson, AZ. p. 4. 1971. (classic text)

"Resource Unit 2: Orientation to Training Program," Agricultural Education Section. Department of Vocational Education, Phoenix, AZ., and Department of Agricultural Education, The University of Arizona, Tucson, AZ. pp. 8-9, HO 10. 1971. (classic text)

32.0 **COMPETENCY/SKILL:** Practices personal and human relations skills.

32.11 **TASK:** Identifies factors which make for job success and satisfaction.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a set of circumstances (case studies) relating to different jobs,

EVALUATION: identify for each job, those factors which make for job success and satisfaction.

STANDARD: The factors must be correctly identified and enumerated.

STUDENT LEARNING EXPERIENCES:

1. Discuss personality traits and how they relate to job success and satisfaction.
2. List basic human needs that affect employee-employer relations.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Write a paragraph about a). a job that was satisfying and they were successful at, and b). a job that did not meet those criteria.
2. Read about job success and satisfaction.

INSTRUCTIONAL EQUIPMENT, MATERIALS AND SUPPLIES:

1. Paper and pen or typewriter.

RESOURCES:

"Resource Unit on Human Relations," Agricultural Education Section. Department of Vocational Education, Phoenix, AZ., and Department of Agricultural Education, The University of Arizona, Tucson, AZ. pp. 1-6. 1971. (classic text)

32.0 **COMPETENCY/SKILL:** Practices personal and human relations skills.

32.12 **TASK:** Gives needed advice diplomatically.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a hypothetical work situation in which it is necessary to counsel an employee,

EVALUATION: give the needed advice diplomatically.

STANDARD: The advice must be communicated effectively with adequate concern for employee's feelings.

STUDENT LEARNING EXPERIENCES:

1. Enumerate the purposes of counseling (advice-giving), i.e. to help the employee make the most of his potential.
2. Explain why listening is most important when giving or taking advice.
3. Demonstrate poor and preferred (tactful) methods of giving advice.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read appropriate reference material in regard to counseling, (advice-giving).
2. Write about an instance in which they thought advice was poorly given and how they thought it could have been given more tactfully.

INSTRUCTIONAL EQUIPMENT, MATERIALS AND SUPPLIES:

1. Paper and pen.

RESOURCES:

Anastasi, T.E. FACE TO FACE COMMUNICATION. General Electric Training Division, Schnectady, NY. p.114. 1975. (classic text)

32.13 **TASK:** Meets people easily.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a hypothetical situation in which one is meeting someone for the first time,

EVALUATION: demonstrate correct form in above situation.

STANDARD: Handshake and exchange of greeting must take place in socially acceptable, yet relaxed fashion.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate proper way of meeting a person for the first time.
2. Discuss common human relation errors which often occur when meeting someone for the first time.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Role play "meeting for the first time" and critique their performance.
2. Write about a situation in which they mishandled a first-time meeting also write about what they would do differently now that they know more about proper greeting methods.

INSTRUCTIONAL EQUIPMENT, MATERIALS AND SUPPLIES:

1. Pen and paper.

RESOURCES:

"Resource Unit on Human Relations," Agricultural Education Section. Department of Vocational Education, Phoenix, AZ., and Department of Agricultural Education, The University of Arizona, Tucson, AZ. 1971. (classic text)

32.0 **COMPETENCY/SKILL:** Practices personal and human relations skills.

32.14 **TASK:** Works under stress.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a work assignment which must be completed within a rigid time frame,

EVALUATION: demonstrate the ability to work under stress.

STANDARD: The assignment must be completed in time with an acceptable level of errors.

STUDENT LEARNING EXPERIENCES:

1. Describe the "flight or fight" reaction.
2. Discuss the statement: "A stressful situation is often not as important as the perception of that situation."
3. List ten common stressors in modern society. (See Task 7.6 Working irregular hours occasionally)
4. List three methods of dealing with stress.
5. Define "stress underload" and "stress overload".

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Consult the references in regard to stress and stress management techniques.
2. Develop their own "stress identification and reduction" program.

INSTRUCTIONAL EQUIPMENT, MATERIALS AND SUPPLIES:

1. Paper and pen.

RESOURCES:

Forbes, R. CORPORATE STRESS: HOW TO MANAGE STRESS ON THE JOB AND MAKE IT WORK FOR YOU. Doubleday and Company, Garden City, NY. pp. 1-147. 1979.

32.0 **COMPETENCY/SKILL:** Practices personal and human relations skills.

32.15 **TASK:** Evaluates performance continually.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a hypothetical situation in which you are the supervisor of several employees,

EVALUATION: evaluate their performance.

STANDARD: During the evaluation the supervisor must:

1. Identify unsatisfactory performance; identify and reinforce satisfactory performance.
2. Evaluate whether unsatisfactory performance is worth the supervisors attention.
3. Discern whether bad performance is due to lack of knowledge by employee. (Does employee know what is to be done and when? Does employee know how to perform task?)
4. Identify any barriers to good performance which are beyond the subordinates control.
5. Find out whether a). negative consequences follow performance, b). positive consequences follow non-performance. (Is the employee being "punished" for good performance? Is the employee being "rewarded" for bad performance?)
6. Discover whether performance is due to lack of desire on the part of the employee. (Could the employee do the job if he or she wanted to?)
7. Redirect the subordinate's behavior through "coaching".

STUDENT LEARNING EXPERIENCES:

1. Demonstrate proper performance "coaching" technique.
2. List three common barriers to good employee performance.
3. Conduct a mock performance evaluation with an employee (student) about a performance problem, i.e. excessive tardiness.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Suggest instances in which they have been successfully "coached."
2. Read the references in regard to performance coaching.
3. Role play a situation in which they will demonstrate correct and incorrect form in performance coaching.

INSTRUCTIONAL EQUIPMENT, MATERIALS AND SUPPLIES:

1. An office setting: 2 chairs, a desk.

RESOURCES:

Fournies, F.F. COACHING FOR IMPROVED WORK PERFORMANCE. Van Nostrand Reinhold Co., New York, NY. 1978.

32.0 **COMPETENCY/SKILL:** Practices personal and human relations skills.

32.16 **TASK:** Dresses appropriately for the job.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given job descriptions for a series of different jobs,

EVALUATION: select appropriate clothing for each job.

STANDARD: The clothing selected must be in accordance with social and/or safety requirements for the job selected.

STUDENT LEARNING EXPERIENCES:

1. Discuss common mistakes in selecting work clothing from both a social and safety standpoint.
2. Demonstrate safety clothing, i.e. pesticide applicator's gear.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read reference materials about clothing selection.
2. Divide the class into two parts and for the following day have one-half dress appropriately for an interview and the other half inappropriately.

INSTRUCTIONAL EQUIPMENT, MATERIALS AND SUPPLIES:

1. Selected safety clothing: boots, safety shoes, respirator, dust mask.

RESOURCES:

Molloy, James T. DRESS FOR SUCCESS. P.H. Wyden Press, New York, NY. 1975.

32.0 **COMPETENCY/SKILL:** Practices personal and human relations skills.

32.17 **TASK:** Remembers names and faces.

PERFORMANCE OBJECTIVE:

CONDITIONS: After being introduced to several new aquaintances, (at least 10),

EVALUATION: be able to remember their names and associate them with their faces.

STANDARD: Eight out of the ten names must be correctly remembered and associated.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate memory techniques used in remembering names and faces.
2. Discuss the importances of remembering names and faces in business.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read the reference material in regard to reading names and faces.
2. Describe their own methods for remembering names and faces and, after they have read the reference(s), have them suggest improvements in their memory technique.

INSTRUCTIONAL EQUIPMENT, MATERIALS AND SUPPLIES:

1. 10 people who are unknown to members of the class.

RESOURCES:

LaRayne, H. and J. Lucas. THE MEMORY BOOK. Ballantine Books, New York, NY. 1975.

32.0 COMPETENCY/SKILL: Practices personal and human relations skills.

32.18 TASK: Judges management and production potential of people.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a hypothetical situation in which there are a series of applicants for a given job,

EVALUATION: select, from their written applications and brief interviews, the "best" qualified candidates.

STANDARD: From 10 applicants, 3 must be selected which meet the criteria of the interviewer. (The interviewer must state his criteria).

STUDENT LEARNING EXPERIENCES:

1. Discuss the difference between the "most qualified" and "best qualified" candidates.
2. List 3 common factors which supervisors use in judging the management and performance potential of an individual.
3. Demonstrate proper interviewing technique, both as interviewer and interviewee.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Read reference material in regard to evaluation and interviewing techniques.
2. Students may conduct mock interviews among themselves, exchanging roles as interviewer and interviewee.

INSTRUCTIONAL EQUIPMENT, MATERIALS AND SUPPLIES:

1. Office setting: Desks and chairs.

RESOURCES:

Weck, T. MOVING UP QUICKLY: HOW TO USE EXECUTIVE JOB-HUNTING TECHNIQUES. John Wiley and Sons, New York, NY. 1979.

33.0 **COMPETENCY/SKILL:** Safely adjusts and operates gas and electric arc welding equipment.

33.1 **TASK:** Sets up, tests and adjusts gas welding equipment.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given cylinders of oxygen and acetylene, regulators, welding torch, hoses, personal safety equipment, and welder's clothing,

EVALUATION: prepare equipment to weld designated joints.

STANDARD: All steps must be completed before igniting the torch. Special observance of all safety precautions must be demonstrated. The metal joints to be welded must be clean and the metals dry.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects to be observed when using gas welding equipment.
2. Set up cylinders.
3. Set up regulators.
4. Set up torch.
5. Operate the torch.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss and demonstrate all safety precautions to students when preparing to weld.
2. Demonstrate the set up procedures for gas welding.
3. Practice set up procedures using designated gas welding equipment.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Welder's clothing, goggles, gloves, cylinders of oxygen and acetylene, pressure regulators, hoses, and welding torch.

RESOURCES:

FUNDAMENTALS OF SERVICE: WELDING. John Deere and Company, Moline, IL. 1984.

33.0 **COMPETENCY/SKILL:** Safely adjusts and operates gas and electric arc welding equipment.

33.1.1 **TASK:** Sets up, tests and adjusts electric arc welding equipment.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given power supply, electrode holder, ground clamp, protective clamp, proctive shield, personal safety equipment, and welder's clothing,

EVALUATION: prepare equipment to weld designated joints.

STANDARD: All steps must be completed before starting the arc. Special observance of all safety precautions must be demonstrated. The metal joints to be welded must be clean and the metals dry.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety aspects to be observed when using electric arc welding equipment.
2. Identify the power supply and type welding machine designated for use, generator, transformer, or rectifier.
3. Connect electrode holder to welding machine.
4. Identify the three types of preferred ground connections.
5. Connect the ground cable.
6. Select a welding helmet or shield with proper lense shade.
7. Check personal safety equipment and welder's clothing.
8. Review all safety precautions.
9. Clean metal to be welded.
10. Identify and select the type electrode needed for assigned task.
11. Install and test (start) arc.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss and demonstrate all safety precautions to students when preparing to weld.
2. Demonstrate to students the set up procedures for electric arc welding.
3. Practice set up procedures using designated electric arc welding equipment.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Power supply, welding machine, electrode holder, ground clamp, protective shield, personal safety equipment, and welder's clothing.

RESOURCES:

FUNDAMENTALS OF SERVICE: WELDING. John Deere and Company, Moline, IL. 1984.

33.0 **COMPETENCY/SKILL:** Safely adjusts and operates gas and electric arc welding equipment.

33.2 **TASK:** Welds using oxy-acetylene equipment.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given gas welding equipment, personal safety equipment, and welder's clothing,

EVALUATION: using oxy-acetylene welding equipment, weld designated joints.

STANDARD: The weld contour must be in accordance with instructor's specifications.

STUDENT LEARNING EXPERIENCES:

1. Set, up test and adjust gas welding equipment.
2. Check temperature chart for melting points of metals.
3. Ignite torch and adjust flame.
4. Weld joints using the forehand or backhand welding method.
5. Stop work, close the oxygen valve first, then close the acetylene valve.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students explain forehand and backhand welding methods.
2. Discuss the selection process for filler rods utilized in welding different types of metals.
3. Demonstrate fusing (or tracking) method when welding designated joints.
4. Discuss the tapering method of welding and the need for this method.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Welder's clothing, goggles, gloves, cylinders of oxygen and acetylene, pressure regulators, hoses, and welding torch.

RESOURCES:

FUNDAMENTALS OF SERVICE: WELDING. John Deere and Company, Moline, IL. 1984.

33.0 **COMPETENCY/SKILL:** Safely adjusts and operates gas and electric arc welding equipment.

33.3 **TASK:** Flame-cuts using oxy-acetylene equipment.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given cylinders of oxygen and acetylene, regulators, cutting torch and tip, hoses, personal safety equipment, and welder's clothing,

EVALUATION: using oxy-acetylene equipment flame-cut designated metal.

STANDARD: The speed, accuracy, and economy of the cutting processs must be in accordance with instructor's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss and observe all safety rules.
2. Attach cutting torch and tip.
3. Connect hoses.
4. Secure the cutting tip into the torch head.
5. Open the cutting torch valves.
6. Light the torch.
7. Adjust the cutting torch flame.
8. Direct the preheat flames on the spot where the cut is to be started whith the flames just cleaning (clearing) the surface.
9. Cut designated metal.
10. When cutting is to be stopped, close the torch oxygen valve, then the acetylene valve.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Following a demonstration, have students discuss the various types of cuts.
2. Discuss the need for different sizes of cutting tips.
3. Identify and select the correct cutting tip size for designated metal.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

Cylinders of oxygen and acetylene, regulators, cutting torch and top, hoses, personal safety equipment, and welder's clothing.

RESOURCES:

FUNDAMENTALS OF SERVICE: WELDING. John Deere and Company, Moline, IL. 1984.

33.0 **COMPETENCY/SKILL:** Safely adjusts and operates gas and electric arc welding equipment.

33.4 **TASK:** Welds using AC and DC arc welding equipment.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a power supply, electrode holder, ground clamp, protective shield and welder's clothing,

EVALUATION: using AC or DC arc welding equipment weld designated metal joints.

STANDARD: All steps must be completed before starting the arc. Special observance of all safety precautions must be demonstrated. The metal joints must be in accordance with instructor's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss and demonstrate the safety precautions for welding.
2. Clean the metal to be welded.
3. Discuss and demonstrate the welding positions used for welding.
4. Discuss the types of joints used in joining metal products.
5. Start the arc.
6. Set the current.
7. Select and adjust the length of arc.
8. Demonstrate the travel speed needed for the weld seam.
9. Form the crater for maximum fusion needed for a strong weld.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the angular positions used in arc welding.
2. Demonstrate single and multiple pass welds.
3. Demonstrate the weaving technique and discuss the purpose for this type weld.
4. Discuss the types of electrodes, and have students select the electrode needed for their tasks.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Power supply, electrode holder, ground clamp, protective shield and welder's clothing, and designated metal.

RESOURCES:

FUNDAMENTALS OF SERVICE: WELDING. John Deere and Company, Moline, IL. 1984.

33.0 **COMPETENCY/SKILL:** Safely adjusts and operates gas and electric arc welding equipment.

33.5 **TASK:** Builds up worn or damaged base metal to original specifications.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a metallizing unit, personal safety equipment and welder's clothing,

EVALUATION: metal spray designated equipment.

STANDARD: All set-up procedures must be completed before igniting the metallizing spray gun. Special observance of all safety precautions must be demonstrated. The metal surface must be clean and all work must be in accordance with instructor's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss the safety precautions to be observed during a metallizing process.
2. Discuss the metallizing process.
3. Ignite the spray gun and regulate equipment to recommendations needed for desired results.
4. Keep each coating within recommended thickness.
5. Repeat spraying until desired/required thickness is built up.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss and demonstrate the two major types of surfacing: hard surfacing and metallizing.
2. Have students explain where metallizing is used.
3. Have students discuss how metallizing works.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Metallizing unit, wire spray gun, respirator, personal safety equipment and welder's clothing, and designated equipment needing metallizing.

RESOURCES:

FUNDAMENTALS OF SERVICE: WELDING. John Deere and Company, Moline, IL. 1984.

33.0 **COMPETENCY/SKILL:** Safely adjusts and operates gas and electric arc welding equipment.

33.6 **TASK:** Applies hard-facing to various metal surfaces.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a power supply, electrode holder, ground clamp, protective shield and welder's clothing,

EVALUATION: using AC or DE arc welding equipment hard-face designated equipment part.

STANDARD: All set-up procedures must be completed before starting the arc. Special observance of all safety precautions must be demonstrated. The metal surface must be clean and all work must be in accordance with instructor's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss and demonstrate the safety precautions for hard-facing equipment.
2. Throughly clean metal to be surfaced.
3. Set the power supply for only enough amperage to maintain an arc.
4. Place the work in a flat position for best results.
5. Use a medium long arc and move with a straight or weaving motion, circular motion for wider surfacing welds.
6. Overlap welds.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the three types of wear that require surfacing: abrasion; impact; and corrosion.
2. Discuss the different types of surfacing materials.
3. Following demonstration, have students practice hard-facing techniques using oxy-acetylene.
4. Discuss the types of surfacing electrodes.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Power supply, electrode holder, ground clamp, protective shield and welder's clothing, and designated part.

RESOURCES:

FUNDAMENTALS OF SERVICE: WELDING. John Deere and Company, Moline, IL. 1984.

34.0 **COMPETENCY/SKILL:** Uses and maintains hand, power and diagnostic tools.

34.1 **TASK:** Knows and observes shop safety precautions.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given instruction in shop safety procedures,

EVALUATION: successfully demonstrate safe and proper use of designated hand tool, i.e., ball peen hammer, torque wrench, or screwdriver.

STANDARD: Demonstrated use of designated hand tool must be executed in accordance with instructor's specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss general safety precautions in the use of personal safety equipment, shop safety equipment, and supplies.
2. Demonstrate the safe and proper use of a common screwdriver, or other designated hand tool.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Identify and demonstrate the use of the types of shop tools.
2. Provide safety instruction on the use of personal safety equipment, laboratory equipment and supplies.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Service manual, shop safety manual, hand tools, and personal safety equipment.

RESOURCES:

FUNDAMENTALS OF SERVICE: SHOP TOOLS. John Deere and Company, Moline, IL. 1980.

34.0 **COMPETENCY/SKILL:** Uses and maintains hand, power and diagnostic tools.

34.2 **TASK:** Uses screwdrivers.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given instruction in the proper use of screwdrivers,

EVALUATION: use the five basic types of screwdrivers on proper screws.

STANDARD: Demonstrate safe and proper use of designated screwdrivers.

STUDENT LEARNING EXPERIENCES:

1. Discuss general safety precautions in the use of screwdrivers.
2. Demonstrate the safe and proper use of screwdrivers.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Identify and demonstrate the use of the basic types screwdrivers found in the Agricultural Machinery Service Laboratory.
2. Provide safety instruction on the use of personal safety equipment, laboratory equipment and supplies.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Five basic screwdriver designs: common; cross-recessed head; clutch-head; offset; starting-and personal safety equipment.

RESOURCES:

FUNDAMENTALS OF SERVICE: SHOP TOOLS. John Deere and Company, Moline, IL. 1980.

34.0 **COMPETENCY/SKILL:** Uses and maintains hand, power and diagnostic tools.

34.3 **TASK:** Uses hammer.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given instruction in the proper use of the various types of hammers,

EVALUATION: use a steel hammer and soft hammer on designated projects.

STANDARD: Demonstrate safe and proper use of steel hammer and soft hammer.

STUDENT LEARNING EXPERIENCES:

1. Discuss general safety precautions in the use of various types of shop hammers.
2. Demonstrate the safe and proper use of shop hammers.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Identify and demonstrate the use of the basic types of hammers.
2. Provide safety instruction on the use of personal safety equipment, laboratory equipment and supplies.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Ball peen hammer, lead hammer, rawhide hammer, plastic hammer, brass hammer, rubber hammer, and personal safety equipment.

RESOURCES:

FUNDAMENTALS OF SERVICE: SHOP TOOLS. John Deere and Company, Moline, IL. 1980.

34.4 TASK: Uses pliers.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given instruction in the proper use of the various types of pliers,

EVALUATION: use several types of pliers for completing tasks for which each is designed, i.e., holding, cutting, or handling small objects.

STANDARD: Demonstrate safe and proper use of pliers.

STUDENT LEARNING EXPERIENCES:

1. Discuss general safety precautions in the use of various types of pliers.
2. Demonstrate the safe and proper use of pliers.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Identify and demonstrate the use of the basic types of pliers.
2. Provide safety instruction on the use of personal safety equipment, laboratory equipment and supplies.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Combination pliers, diagonal cutter pliers, side cutter pliers, needle-nose pliers, lock-grip pliers, snap ring pliers, and battery pliers.

RESOURCES:

FUNDAMENTALS OF SERVICE: SHOP TOOLS. John Deere and Company, Moline, IL. 1980.

34.0 **COMPETENCY/SKILL:** Uses and maintains hand, power and diagnostic tools.

34.5 **TASK:** Uses wrenches.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given instruction in the proper use of the various types of wrenches.

EVALUATION: use several types of wrenches for completing tasks for which each is designed, i.e., open-end, adjustable open-end, box wrenches, and ets.

STANDARD: Demonstrate safe and proper use of wrenches.

STUDENT LEARNING EXPERIENCES:

1. Discuss general safety precautions in the use of various types of wrenches.
2. Demonstrate the safe and proper use of wrenches.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Identify and demonstrate the use of the basic types of wrenches.
2. Provide safety instruction on the use of personal safety equipment, laboratory equipment and supplies.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Open-end wrenches, adjustable open-end wrenches, box wrenches, socket wrenches, set screw wrenches, spanner wrenches.

RESOURCES:

FUNDAMENTALS OF SERVICE: SHOP TOOLS. John Deere and Company, Moline, IL. 1980.

34.0 **COMPETENCY/SKILL:** Uses and maintains hand, power and diagnostic tools.

34.6 **TASK:** Uses a torque wrench.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given instruction on the use of the SAE and metric torque wrenches,

EVALUATION: use a SAE and metric torque wrench to tighten designated bolts.

STANDARD: Demonstrate safe and proper use of a torque wrench, the bolt tightness must be in accordance with recommended specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss general safety precautions in the use of various types of wrenches.
2. Discuss the criteria needed for selecting the proper size and range of a torque wrench.
3. Check torque wrench for accuracy.
4. Demonstrate the safe and proper use of a torque wrench.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Identify and demonstrate the use of the SAE and metric torque wrench.
2. Identify and demonstrate the use of torque wrench adapter or extension.
3. Provide safety instruction on the use of personal safety equipment, laboratory equipment and supplies.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. SAE torque wrench, metric torque wrench, SAE bolt torque chart, and metric bolt torque chart.

RESOURCES:

FUNDAMENTALS OF SERVICE: SHOP TOOLS. John Deere and Company, Moline, IL. 1980.

34.0 **COMPETENCY/SKILL:** Uses and maintains hand, power and diagnostic tools.

34.7 **TASK:** Uses micrometers.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given instruction on the use of various types of micrometers,

EVALUATION: demonstrate the proper use of an outside micrometer by measuring a designated part.

STANDARD: The outside measurement must be accurate to within a very minute part of an inch.

STUDENT LEARNING EXPERIENCES:

1. Discuss general safety precautions in the use of various types of micrometers.

2. Discuss the criteria needed for selecting the proper micrometer for measuring designated part.

4. Demonstrate the safe and proper use of a micrometer.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Identify and demonstrate the various types of micrometers.

2. Following demonstration, have students measure designated parts using the corect micrometer.

3. Provide safety instruction on the use of personal safety equipment, laboratory equipment and supplies.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Outside micrometer, inside micrometer, telescope gauge, and depth micrometer.

RESOURCES:

FUNDAMENTALS OF SERVICE: SHOP TOOLS. John Deere and Company, Moline, IL. 1980.

35.0 **COMPETENCY/SKILL:** Accurately prepares reports and documents.

35.1 **TASK:** Writes work orders.

PERFORMANCE OBJECTIVE:

CONDITIONS:	Given a blank work-order, pen, rubber stamps and a setting in which a customer is requesting repairs on equipment,
EVALUATION:	write work-order for a given situation.
STANDARD:	The work-order must be legible, filled in accurately and completely, and void of errors.

STUDENT LEARNING EXPERIENCES:

1. Discuss department regulations for making out work-orders.
2. Demonstrate how to complete a work-order.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study and discuss department regulations for filling out work-orders from several local firms.
2. Complete work-orders for several specific transactions.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Blank work-orders, rubber stamps, and pen.

RESOURCES:

Walker, Hattie M., et.al.. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

35.0 **COMPETENCY/SKILL:** Accurately prepares reports and documents.

35.2 **TASK:** Prepares estimations of cost for services.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a work-order, pen, calculator, rubber stamps, parts manual/microfiche, flat-rate manual and a setting in which a customer is requesting repairs on equipment,

EVALUATION: prepare an estimation of cost for services.

STANDARD: The cost estimate must be legible, filled in accurately and completely, and void of errors.

STUDENT LEARNING EXPERIENCES:

1. Discuss department regulations for preparing cost estimates.
2. Demonstrate how to complete cost estimates for services.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study and discuss department regulations for giving/preparing cost estimates from several local firms.
2. Complete cost estimates for services for several specific transactions.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Blank work-orders, pen, calculator, rubber stamps, parts manual/microfiche, flat-rate manual.

RESOURCES:

Walker, Hattie M., et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

35.0 **COMPETENCY/SKILL:** Accurately prepares reports and documents.

35.3 **TASK:** Orders parts.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a parts-order-form, pen, parts manual/microfiche, and a setting in which a customer is ordering a part,

EVALUATION: order requested part.

STANDARD: The parts-order-form must be legible, filled in accurately and completely, and void of errors.

STUDENT LEARNING EXPERIENCES:

1. Discuss department regulations for making out parts-order-form.
2. Demonstrate how to complete parts-order-form.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Study and discuss department regulations for preparing parts-order-form from several local firms.
2. Complete parts-order-form for several transactions.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Blank parts-order-forms, pen, parts manual/microfiche, and if available a computer.

RESOURCES:

Walker, Hattie M., et.al.. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

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This comprehensive text, designed specifically for high school students, presents the basic skills of agricultural mechanics in a competency-based, easy-to-follow format.

FUNDAMENTALS OF MACHINE OPERATION: AGRICULTURAL MACHINERY SAEFTY. John Deere and Company, Moline, IL. 1976.

The operation manual is designed as a professional agricultural equipment operator's manual. Instructor and students will find instructions useful and easily read.

FUNDAMENTALS OF MACHINE OPERATION: COMBINE HARVESTING. John Deere and Company, Moline, IL. 1973.

The operation manual is designed as a professional agricultural equipment operator's manual. Instructor and students will find instructions useful and easily read.

FUNDAMENTALS OF MACHINE OPERATION: CROP CHEMICALS. John Deere and Company, Moline, IL. 1976.

The operation manual is designed as a professional agricultural equipment operator's manual. Instructor and students will find instructions useful and easily read.

FUNDAMENTALS OF MACHINE OPERATION: PREVENTIVE MAINTENANCE. John Deere and Company, Moline, IL. 1973

The operation manual is designed as a professional agricultural equipment operator's manual. Instructor and students will find instructions useful and easily read.

FUNDAMENTALS OF MACHINE OPERATION: TILLAGE. John Deere and Company, Moline, IL. 1976.

The operation manual is designed as a professional agricultural equipment operator's manual. Instructor and students will find instructions useful and easily read.

FUNDAMENTALS OF MACHINE OPERATION: TRACTORS. John Deere and Company, Moline, IL. 1974.

The operation manual is designed as a professional agricultural equipment operator's manual. Instructor and students will find instructions useful and easily read.

FUNDAMENTALS OF SERVICE: SHOP TOOLS. John Deere and Company, Moline, IL. 1980.

The service manual is designed to explain the use of shop tools. These materials provide basic information in power mechanics for use by teachers as well as shop servicemen and the student. Emphasis is on theory of operation, diagnosis, and repair.

Herbst, J. H. FARM MANAGEMENT: PRINCIPLES, BUDGETS, PLANS. Stipes Publishing Company, Champaign, IL. 6TH REV. ED.

Hunt, Donnell. FARM POWER AND MACHINERY MANAGEMENT: LABORATORY MANUAL AND WORKBOOK. Iowa State University Press, Ames, IA. 6TH ED. 1976.

Jacobs, Clinton O., and William R. Harrell. AGRICULTURAL POWER AND MACHINERY. McGraw-Hill Book Company, NY. 1983.

Jacobs, Clinton O., Mervin Stearns, and Keith E. Mattox. FARM TRACTOR MAINTENANCE: A UNIT OF INSTRUCTION ON FARM TRACTOR MAINTENANCE FOR VOCATIONAL AGRICULTURE. Department of Agricultural Education, University of Arizona, Tucson, AZ. 1975.

This instructional guide provides the teacher of vocational agricultural mechanics with a plan of activities in farm tractor maintenance which are student oriented to the essential tasks common to modern farm tractors.

McCann, Edward W. et.al. TRACTOR MECHANIC: COMPETENCY BASED EDUCATION CURRICULUM. Virginia Polytechnic Institute and State University Press, Blacksburg, VA. 1978.

The material is designed as a student Tractor Mechanic Competency Based Education Curriculum. It has been developed in order to facilitate vocational agricultural mechanics students in learning to be tractor mechanics. These competency sheets are intended for use by both students and instructor.

Walker, Hattie M. et.al. AGRICULTURAL MACHINERY SERVICE: INSTRUCTIONAL RESOURCE GUIDE. Agricultural Education Service, Department of Education, Richmond, VA. 1983.

This instructional resource guide is designed to assist teachers and administrators in developing instructional materials that meet the needs of students and industry and comply with set standards.

9940 COTTON PICKER TECHNICAL MANUAL FM 1356. John Deere and Company, Moline, IL. 1985.

The technical manual is designed as a professional agricultural mechanic's reference. Students and instructor will find instructions useful and easily read.

NOTE: Audiovisual materials are available from:

1. Teaching Aids
   711 W. 17th Street, Unit E2
   Costa Mesa, CA. 92627

2. Venard Films, Ltd.
   Box 1332
   Peoria, IL. 61654